SCIENTIFIC AMERICAN

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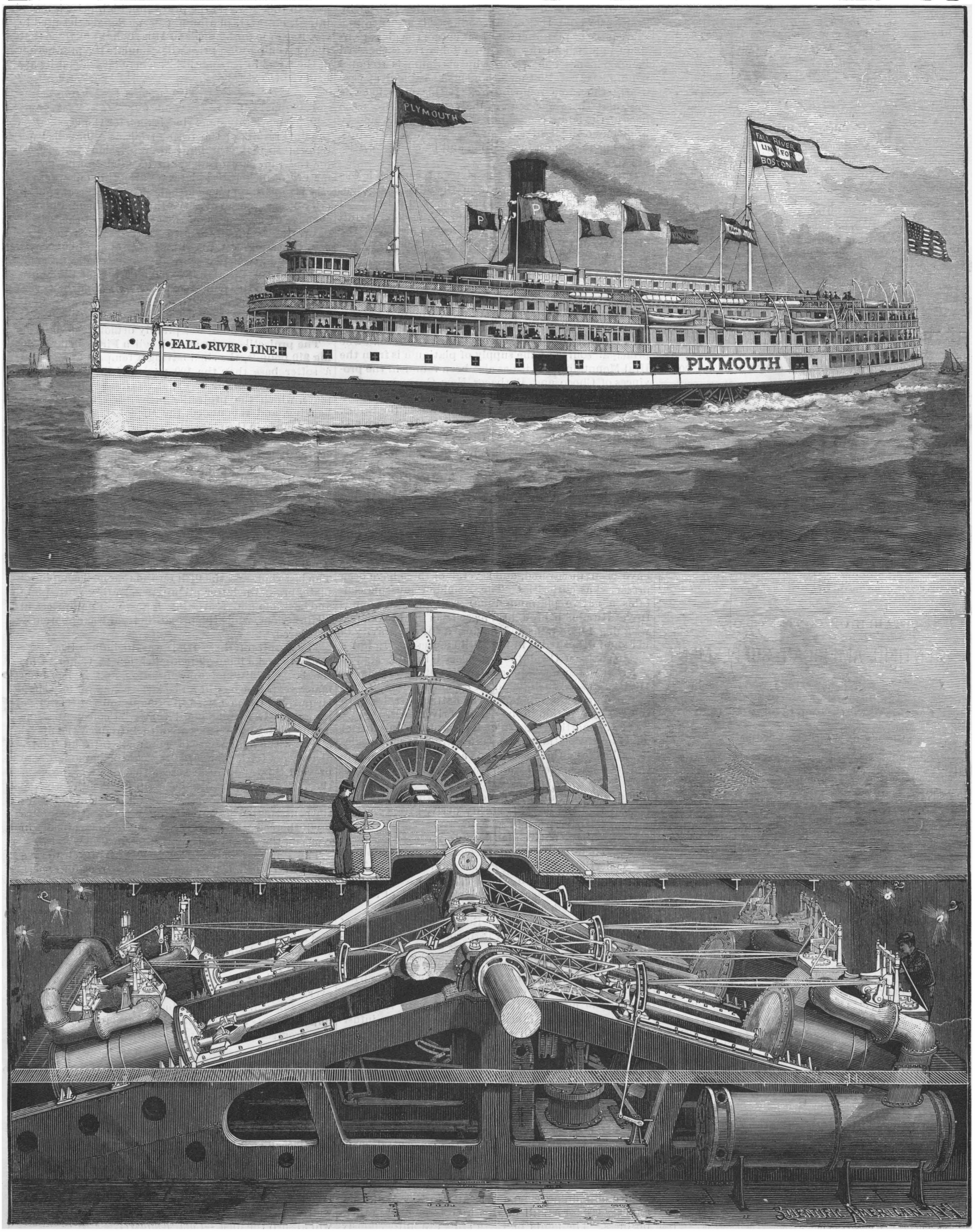

THE NEW STEAMER PLYMOUTH, OF THE FALL RIVER LINE.—[See page 214.]

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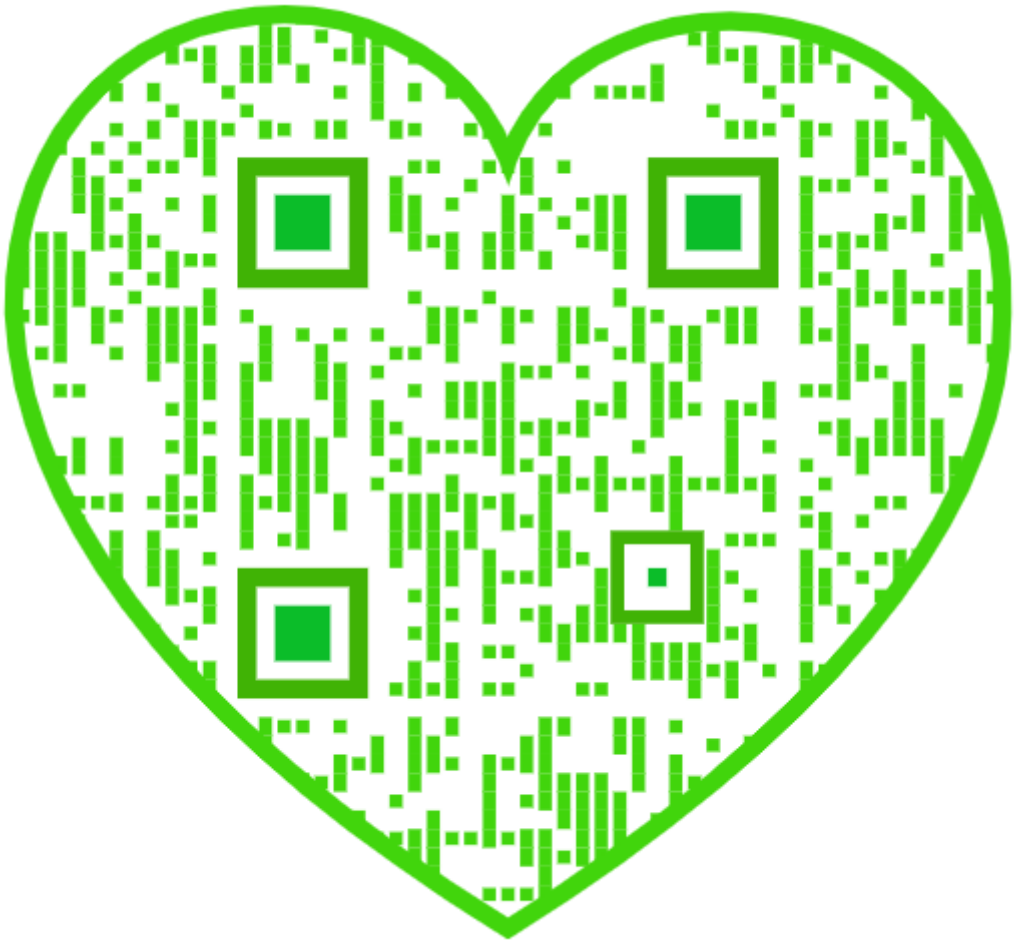

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Contents.

(Illustrated articles are marked with an asterisk.)

Alaska, exploration of..... 212
Ballooning, war..... 210
Batteries, dry, filling for..... 211
Bottles, glass, cutting..... 213
Business and personal..... 218
Cholera in Japan..... 211
Diphtheria, inoculation treatment..... 211
Earnings, railroad..... 210
Engine, rotary, new*..... 210
Engine, steam, managing..... 213
Gun, Giffard..... 213
Gutta-percha, liquid..... 210
Habit, regularity of..... 211
Hints worth heeding..... 213
Holder, lace*..... 210
Industries of Virginia*..... 211
Lighting, electric, history..... 215
Mechanic, decay of..... 217
Meerschaum, artificial..... 209
Memory for names 212
Metals, coloring of 212
Musician, precocious..... 217
Niagara Falls, power from..... 212
Notes, botanical..... 217
Patents, relation to exports..... 209
Platinum..... 208
Plymouth, steamer*..... 207, 214
Power, water, at Geneva..... 209
Problem, belt..... 213
Rifles, modern, power of..... 209
Roller and drill, combined*..... 211
Science, our debt to..... 217
Sleepers, metal, railway..... 209
Snakes, climbing..... 216
Store, how to sweep..... 208
Strainer and funnel, Lake's*..... 210
Stumps, to destroy..... 213
Suit, loom, ended..... 210
Tea, Paraguay..... 213
Tree, banyan*..... 215
Trees, longevity of..... 212
Vessels, war, nickel-steel plates for our..... 208
Vise, improved, Squier's*..... 210
World, end of..... 216

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 770.

For the Week Ending October 4, 1890.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—A Connecticut Peach Orchard.—By J. H. HALE. Concluding portion of this very interesting and practical study of farm life at the present day..... 12307

II. ARCHITECTURE.—The Roche-sur-Yon Covered Market.—A market recently erected from competitive plans.—1 illustration... 12299

III. ASTRONOMY.—Prof. De Volson Wood on "Constitution of Celestial Space."..... 12310

IV. GUNNERY AND ORDNANCE.—Smokeless Powder—The Explosives of the Past and of the Future.—A full account of the Nobel smokeless powder, with interesting particulars of its use and the probable future of smokeless powder.—5 illustrations.. ... 12308

V. MECHANICAL ENGINEERING.—Working Locomotives with Petroleum Fuel.—The second installment of this most interesting paper, giving the results of actual experience with liquid fuel.—19 illustrations..... 12296

VI. MEDICINE AND HYGIENE.—The Physiological and Therapeutical Action of Sulphur.—By JOHN V. SHOEMAKER.—Interesting *resume* of the present theories of the action of sulphur on the human system..... 12302

VII. METALLURGY.—Refractory Materials.—By T. EGLESTON.—The continuation of this valuable paper, treating of the manufacture of furnace linings and fire bricks..... 12299

VIII. MISCELLANEOUS.—A Burglar's Kit.—A full description of the tools used and methods of work adopted by burglars.—8 illustrations..... 12304

The Argentine Republic and its President.—Notes of the country and its president, the site of the recent financial crisis and insurrection.—2 illustrations..... 12306

IX. NAVAL ENGINEERING.—A Hydraulic or Jet Propelled Steam Lifeboat.—A successful boat propelled by a water jet, full details and account of the principal features of the construction and of her trials for maneuvering power.—4 illustrations..... 12295

X. PHOTOGRAPHY.—Photo-Micrography.—By ANDREW PRINGLE.—The photography of microscopic objects, with hints for future work in this line..... 12300

The Automatic Operation of Photographic Apparatus.—By Prof. D. P. TODD.—The apparatus as used in observing the last eclipse on the coast of West Africa..... 12301

The Photographic Necktie.—A new version of the detective camera described and illustrated.—3 illustrations..... 12302

XI. PHYSICAL GEOGRAPHY.—The Sahara Desert.—The present aspect of the great desert and future prospects of the region..... 12304

PLATINUM.

The price of platinum has recently advanced very greatly, until now it is nearly equal in value to gold. In July, 1889, the price was $8 an ounce, six months ago it was $14, and at this writing it is $20 an ounce, while gold is quoted at $20.70. This rapid rise in the value of the metal is due to the steadily increasing demand from the manufacturers of electrical apparatus. Every incandescent electric lamp requires about one inch of platinum wire, and nothing has yet been found to take the place of it. Large sums of money have been expended in the prosecution of experiments having for their object the discovery of a substitute for platinum wire in the manufacture of electric lamps, but without satisfactory results. In the Edison incandescent lamp the copper conductor is attached to a short piece of platinum wire as it enters the glass pear-shaped globe, and the platinum joins the carbonized bamboo loop. The reason why platinum is so indispensable is that that metal and glass expand at very nearly the same temperature. If this were not the case, and there was an unequal expansion from the heat of the lamp, the seal of the glass globe would be broken and the light soon extinguished. The history of this metal is most interesting, and its characteristics are very remarkable.

During the first half of the sixteenth century it was observed that the gold ore from the mines at Darien, in South America, included grains of a whitish metal which was deemed to be a noble metal, and yet it differed in a marked degree from silver. The fact of the discovery of this metal was not made known by the Spanish government, because they found that it furnished an excellent material for adulterating gold, and none of it was allowed to be exported. It was only at about the middle of the last century that the metal began to find its way into Europe, where it became known as a curiosity under the Spanish name of platina del Pinto (the little silver from the river Pinto). The principal source of the supply of platinum is from the Ural Mountains, but it has also been found in the provinces of Choco and Barbacos, New Granada, and in Brazil. It occurs also in San Domingo, on the island of Borneo, in Honduras, among the sands of the Rhine, and in the County Wicklow, Ireland. It is also met with in California, at Rogue River, Oregon, in Rutherford County, North Carolina, and in Canada.

The Ural Mountain deposits were discovered about 1823, and they have been worked by the Russian government since about 1828. According to Daubre, the Ural ore was embedded originally with chrome iron in a serpentine derived from olivine.

Platinum ore is found in alluvial districts in the *debris* of the earliest volcanic rocks. It is generally found in small grains, but masses of considerable size have been discovered, and several of these have been preserved as curiosities. The Demidoff museum contains a native platinum lump weighing 21 pounds troy. Humboldt brought a piece from South America weighing 1,088 grains and having a specific gravity of 18·94 and deposited it in the Berlin museum. In 1822 a specimen from Condato was placed in the Madrid musuem which was 2½ inches in diameter and weighed 11,641 grains. When found in its native state, it is in rounded grains or nuggets, or in flattened scales worn smooth by attrition in the gravel of river beds.

On the northern coast of California, a mixture of gold and the platinum metals in extremely small scales is washed from the beach sand, and from this mixture the gold is removed by amalgamation.

From observations made of the rocks and minerals found with platinum in deposits, the theory has been formed that the metal is chiefly derived from the disintegration of serpentine rock.

Nearly all the native platinum is more or less magnetic. There were several specimens of this kind in the collection sent to the Paris exposition, in 1867, by Prince Demidoff, upon whose estate in Russia there are a number of places where large masses of the ore have been found.

Platinum was coined by Russia to the extent of $2,500,000 between 1826 and 1864, when the coinage was discontinued.

Almost all platinum contains iridium, which greatly increases its hardness and durability without impairing its power of resisting chemical agents, and it has been termed the metal of the chemist. Liebig said that "without platinum crucibles, which share the infusibility of porcelain with the chemical inertness of gold ones, the composition of most metals could not have been ascertained, and chemistry could not have come to its present level." The unalterability of this metal at high temperatures, and its power of resisting the action of most chemical agents, makes it invaluable for crucibles, evaporating dishes, forceps, and foil for blowpipe experiments. One of its most important uses is for large evaporating stills for the concentration of sulphuric acid. A still of this kind valued at $19,000, exhibited at Vienna in 1873, was capable of concentrating 20,000 pounds of sulphuric acid daily. A well known oil-refining company located in New York City paid $24,000 for a still of this kind to be used in their business. The joints of these stills are autogenously soldered, thus giving them entire uniformity of material, and making the whole vessel of one piece. It would not, however, be possible to produce such large homogeneous vessels without the aid of the blowpipe.

As early as 1837, Dr. Hare, of Philadelphia, proposed to melt platinum and he succeeded in melting 28 ounces into a malleable, homogeneous mass. MM. Deville and Debray have conducted a number of successful experiments with platinum, so that ingots of large size can now be made.

Still another use to which platinum has been put is in the manufacture of jewelry. Its dull, steel-gray color prevents it from being ornamental in itself, but it is plated with gold, and large quantities of it have been used in this way. If the prevailing high price is maintained, however, platinum can no longer be used in this line of manufacturing. It is thought by some that the prevailing high price will stimulate the production of the metal in Russian fields, where large deposits are believed to exist.

NICKEL-STEEL PLATES FOR OUR WAR VESSELS.

The remarkably short time it took for Congress, after the final results of the recent trials at Annapolis were known, to make the large appropriation of $1,000,000 for the purchase of nickel to be used in the manufacture of nickel-steel plates for armoring our war vessels is something phenomenal. The very great superiority of such plates over the English compound plates, such as used on most of the armorclads of the British navy, was so plainly shown at the trials as to admit of no question, but the superiority of the nickel-steel over the all-steel plates was by no means so decided, and there appears at first to have been some difference of opinion on this point. On the final trial, however, when only one shot was fired at the center of each of the plates from an eight-inch gun, the superiority of the nickel-steel plate was plainly demonstrated.

The projectile used was an English Firth shell weighing 210 pounds, the shell having a tempered point and a softer base than the 100 pound shells used in the previous trials. The first shot was fired at the all-steel plate, which the projectile penetrated into the oak backing, and rebounded, the shell being broken up. It had made in the plate a ragged orifice with splintered edges, and four narrow cracks radiated from the center hole to each corner of the plate, through the holes which had been previously made by the six-inch projectile. The next shot was at the center of the nickel-steel plate, which was penetrated, the shell burying its point therein, while the base of the shell was broken into small pieces and scattered in all directions. There were, however, no cracks in the plate, whose structure seemed to be uninjured except where it had been struck by the five different projectiles. The last shot, and the fifth on the Cammell compound plate, broke the latter all up, penetrating both plate and backing and scattering large and small pieces in all directions, while the projectile itself was apparently uninjured.

The result of these trials was to induce Secretary Tracy to make immediate application to Congress for the large additional appropriation, and it has been many years since a call for so large a sum for any similar purpose has met with so prompt and satisfactory a response. It is announced that the contractors for armor plates have consented to introduce the nickel alloy, without change of contract, into all plates already not too far forward in process of manufacture to prevent this, and thus it is seen that one advantage of the very first importance has been obtained by the deliberation and thorough care thus far manifested in the construction of our new navy. The armor plates used thereon will be far superior to those already in place on the armorclads of all present war vessels.

The question of alloying steel with nickel, to give greater strength, is not, however, a new one, for experiments in this direction have been conducted by prominent firms for some years past, both on armor plates and gun barrels. The amount of nickel used in the Creusot plate recently tested is said to have been three and a half per cent, but is by no means considered settled that this is absolutely the best proportion to use, and if it proves to be the best for armor plates, it may not be the best for other uses. It is safe to say, however, that the trials so successfully conducted at Annapolis will give a great impetus, not only to further improvements in armor plates, but also to a corresponding progress in the manufacture of guns and projectiles.

How to Sweep a Store.

We don't use a leaky old sprinkling pot to sop the floor all over in puddles when we sweep. No, sir! We have wet sawdust, and I put a row of it across one end of the store and sweep that right along to the other end, just like a regiment marching across a ten acre lot. It catches all the dirt and carries it along. If it gets a little dry, I add some more. Some folks scatter sawdust all over the floor, but Mr. Vanders says that's no good; that the reason for using sawdust is to avoid wetting the floor all over and to have something that will absorb the dust.—*Com. Enquirer.*

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Water Power at Geneva.

The river, as it passes through the city, is divided into two channels by an island covered with buildings. Col. Turrettini proposed that the right arm of the river should be reserved for running off the water, while the left arm, transformed into an industrial canal, was to conduct the water into a building to be constructed in the bed of the river, and in which would be placed, as they were required, twenty turbines with 4,400 net horse power. The whole of this work is now done, except that only half of the turbines are in use. The method of distributing the motive power gave rise to a good deal of discussion, but, as Geneva does not possess any large manufactories for which transmission by cable is suitable, the system of transmission by hydraulic pressure was adopted, and the municipality decided to make two canalizations, one with low and the other with high pressure, the latter with an ascending force of 460 ft.

A curious feature of this work was the successive emptying of the two channels of the river. While each was dry nearly the entire population of the city flocked into it, led by curiosity. Several great public banquets and other festivities were held in each of the river beds. The channels were then made deeper and a uniform slope made from the mouth of the lake down to the turbines. Opportunity was also taken to construct upon the banks of the stream large sewers, which run along the two banks of the lake and of the Rhone for a distance of more than three miles. These sewers empty into the Rhone below the town, and thus prevent the water, which is used by the inhabitants, from being contaminated. From a hygienic point of view, this has been most successful, the number of deaths from typhoid fever last year being only nine out of a total population of 73,000.

As an industrial enterprise the work is a great success. At the commencement of this year there were no less than 216 industrial motors with a force of 1,565 horse power. All kinds of trade and industry make use of the water power, while the amount of force varies very much, the minimum being a third of a horse power for sewing machines, and the maximum, up to the present, 625 for an electric light company. The total cost of the work has been $1,420,000, of which about $1,000,000 has been for the account of the municipality, while the gross return upon the sale of water in 1887 reached $115,000, or 150 per cent more than it was nine years before, which, after deducting all the cost of maintenance, staff, interest, and paying off the capital invested, leaves a clear profit of $37,500. The demands for more motive power are steadily increasing, and it is anticipated that in a few years' time all the turbines will be in use, and that the municipality will have to fall back on the opportunity of obtaining, at an island some way down the Rhone, a fresh motive force of 7,000 horse power, and transmit it to Geneva by electricity.—*New York Tribune.*

The Relation of Patents to Exports.

A subscriber asks how it is, when wages are higher here than in almost any other country, that the United States can find a market abroad for so many articles of hardware and machinery, in competition with the active business rivalry of England and Germany. As *Hardware* recently asserted, the secret of the extent of our exports under such circumstances lies in the excellence of American manufactures—they sell upon their own merits. To be more explicit, the sale of such goods as are now exported from the United States is not governed by the price. When the Japanese can buy rope-making machines in Boston by the hundred, and get them operated in their own country by laborers hired at three dollars per month, it is not likely that the United States will soon be distinguished in foreign markets for offering goods cheaper than native labor can produce them. American hardware is exported to-day because it is better than the goods of the same class made elsewhere, and the people who buy it are willing to pay the price rather than buy undesirable goods for less money. Either this is the case, or the articles exported are patented specialties which cannot be manufactured abroad because of the protection secured by patenting the inventions all over the world.

This question of patents is the most important one to be considered in connection with the future foreign trade of this country. In Germany, for instance, our inventors, manufacturers, and merchants were welcomed under the empire. An American brand upon an implement was its highest recommendation. Depots and agencies were established there for the sale of American goods until there were probably fifty in different parts of the empire, all doing an active business. That was little more than ten years ago, but now nearly all the agencies are closed. The extremely clever German machinists set at work promptly to imitate our hardware, stoves, agricultural implements, boot and shoe machinery, and sewing machines, even copying some of the American trade marks. These imitations, though not equal to the originals, were far cheaper in price, and the sale of American goods was greatly checked. The trouble was that the latter had not been protected by patents in Germany.

It is not too late to take warning from this. Our consul-general at Frankfort, Mr. Frank H. Mason, writing of the Electro-Technical Exposition to be held there in 1891, writes thus strongly:

"Let it be understood at the outset that it is useless to bring here for general sale any invention that is not severely protected by a German patent. If it is valuable, it will be assuredly copied unless the patent is vigorously defended."

The case is cited of a meat-cutting machine, manufactured in Philadelphia, which was introduced in Germany a few years ago and was at once copied, as it was an article that immediately became popular. But the American makers went over, defended their patent before the courts, stopped the infringement, and now have a heavy and steadily growing trade. But a grating machine, sent over from Massachusetts, has been copied on a large scale in Berlin, and as the patent has not been defended, the original machine has been driven out of the German market.

The best-selling American goods in foreign markets to-day may at any time be imitated so successfully as to stop the demand from this country. It is so with nearly everything we try to sell in China and Japan. Even bicycles and expensive scales are imitated in the latter country and sold very cheaply. Our manufacturers cannot begin too soon to study the patent laws of the Old World, but meanwhile there is no reason to relax their efforts to sell their products in every land under the sun.—*Hardware.*

Metal Sleepers for Railways.

In a "Preliminary Report on the Use of Metal Track on Railways as a Substitute for Wooden Ties," published under the auspices of the United States Department of Agriculture, by Mr. E. E. Russell Tratman, C.E., a very interesting summary is given of information concerning the use of metal ties as a substitute for wood in the construction of the permanent way of railways. Although the Department of Agriculture is not directly concerned with the management of railways, this investigation comes legitimately within its province, since it is in the interest of forest preservation. Mr. Tratman is surprised that American engineers, who are usually in the van of any great step in the profession, should have paid so little attention to this important matter—important both as to the financial economy and the practical efficiency of the track. In his opinion steel ties should be used as the standard for first-class track, and not merely as a substitute for timber when the latter becomes scarce or expensive. One of the most interesting parts of Mr. Tratman's report is his full account of the steps taken in other countries with regard to the question of metal ties. He states that experiments with steel ties have been made in England for several years, but with unsatisfactory results, owing to the form of the rail used. The most extensive and valuable trials have been made in Holland under the direction of M. J. W. Post, engineer of permanent way of the Netherlands State Railway Company, who began his experiments in 1865, and has continued them until the present time. The steel tie designed by Mr. Post, and improved by him from time to time in the light of practical experience, has been adopted upon this system. In the early part of 1888, 91 miles of track had been laid with these ties. Of 10,000 ties laid in 1865, 9,550 were still in the track in 1888, and were expected to last twenty years more, although they were of the earlier type of the tie which has since been improved upon. As to breakages, out of 162,634 ties laid, not one had broken. In the early part of 1888, there were in use in various countries about 730,000 ties, or 36,500 tons, of this one type. On the state railways of Germany a number of different systems of metal track have been tried for several years. In 1887, the state railway system had 3,131 miles laid with metal cross ties and 2,399 with metal longitudinals, making in all 5,530 miles of metal track. The experience with iron longitudinals and cross ties was very favorable, but still better results have been obtained since steel was introduced. Ties of wood are still used in great numbers, partly on account of their lower first cost and partly on account of the policy of the German government to keep up the supply of timber by domestic cultivation and forest management.

Austria has about 200 miles of longitudinal systems of metal track, which have been laid in small sections, year by year, since 1876. In Switzerland the Central Railway had 109,000 metal ties in use at the end of 1884, and proposed to lay 30,000 per annum till its whole system had been thus laid. The Western and Simplon railways began using metal ties in 1883, and have been very well satisfied with them. The Gotthard Railway uses them very extensively, and they have also been adopted on the Mount Pilatus rack railway. In India 300 miles of the state lines are laid with steel ties, and there are over 1,600 miles laid with cast iron tracks of different types. In Queensland, Australia, a few miles of railway have been laid with the Phillips type of metal tie. This is a steel cross tie intended for prairie work, where the track is laid on the surface of the ground, and is designed to be used without ballast, being simply packed with surface soil. In the Argentine Republic the Buenos Ayres Great Southern Railway, which began operations in 1865, has 13¾ miles of double track and 819½ miles of single track laid with cast iron sleepers. The Central Argentine Railway has 246 miles laid with cast iron track. The American inventor has not been idle, although his labors have not found favor with engineers. From 1839 to February, 1889, no less than 256 patents for metal tracks were issued. Among the American railways which are reported as having made experiments with metal ties are the Boston and Maine, the Maine Central, the Long Island, New York Central, and Pennsylvania.

Mr. B. E. Fernow, chief of the Forestry Division of the Agricultural Department, who has compiled the report, is of opinion that there cannot longer be a doubt that it is possible to construct a metal tie which will be superior in all respects to wooden ties; yet to bring its first cost down to such a figure that the future saving in its maintenance need not enter into consideration, but may be taken as an agreeable surprise in the cost of management, is what railway companies are most bent on obtaining. Especially in the United States, where the present accounting outweighs in importance all future possible profits, this consideration alone, of reduced first cost, may be sufficient to work a revolution in the use of railroad ties. On the other hand, the bugbear of cheapness, which is often taken for an equivalent of economy, is apt to mislead the inventor into risking the factors of safety and strength in order to attain cheapness.

Artificial Meerschaum.

The following is given in the *Zeitschrift fur Angewandte Chemie* as a new process for preparing artificial meerschaum.

The following precipitates are prepared by means of a solution of soluble glass: (1) of silicate of magnesia by precipitating it through a solution of sulphate of magnesia; (2) of silicate of alumina by precipitating through a solution of alum; (3) of silicate of lime by precipitating through a solution of chloride of calcium.

All these solutions are diluted, one part of salt being used for 10 parts of water. In order to precipitate the solutions, the operation is performed at 20°, except in the case of the silicate of alumina, for which the solutions have a temperature of about 50°. (4) A solution of fused chloride of calcium (1 part to 15 parts of water) is precipitated at between 15° and 20° by a solution of sulphate of soda (1 to 15). The precipitate of sulphate of lime is first dried and then freed of the larger part of the water that it may contain by compressing it and exposing it upon hurdles in a stove. Finally, it is totally dehydrated by heating it in a very clean iron kettle. The sulphate of lime thus prepared is in the form of a very fine and very white powder. It is carefully preserved in boxes that are kept in a perfectly dry place.

Into 33 pounds of water at 40° are put 19 pounds of precipitate (4) in 20 successive and nearly equal portions. The mixing should be done with much care and with rapid stirring. There are afterward added to the mixture the following substances, weighed in advance:

7¾ lb. of precipitate	(1)
3⅜ " " "	(2)
5½ " " "	(3)

All these precipitates should be mixed with water, and then the mass, which is in the form of a thin *bouillie*, is immediately introduced into a vessel through a No. 20 brass sieve, and thence into wooden boxes that rest upon large slabs of plaster covered with canvas, and about four inches in thickness.

In about from 15 to 25 minutes the mass may be detached from the sides of the frame by means of a blunt blade of brass, and the frame may be removed.

The mass is left upon the slabs of plaster until it is sufficiently dry to be sawed into small blocks of various dimensions, according to requirements. These blocks are more thoroughly dried upon hurdles in a stove. Then they are worked with a knife or in a lathe, and are waxed and polished as in the case of objects made of genuine meerschaum.

It should be remarked that, on introducing the hot mixture into the frame, care should be taken not to introduce air bubbles at the same time.

Varying proportions of precipitates (1), (2), and (3) may be used. The larger the proportion, the harder and heavier will be the final mass.—*Moniteur Scientifique.*

THE range and penetrating power of the modern rifles are tremendous. The six-inch rifle will hurl its projectile through ten and a half inches of wrought iron a thousand yards from the muzzle. The eight-inch rifle will pierce sixteen and three-tenths inches of iron at the same distance. The ten-inch rifle that the rejuvenated Miantonomoh will carry will send its missile through twenty-one inches of iron a thousand yards away. The twelve-inch rifle, of which we are to have a supply in the future, will penetrate twenty-eight inches of iron at a range of three thousand feet.

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War Ballooning.

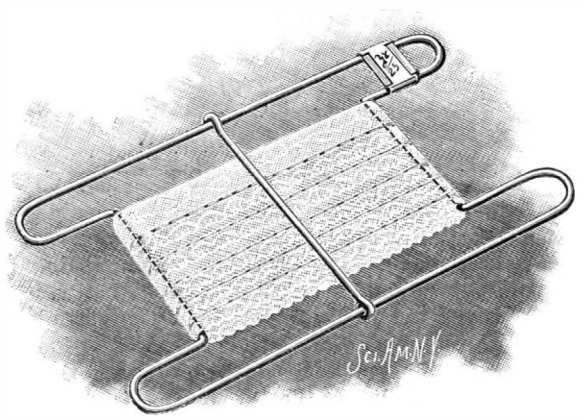
A correspondent of the London *Times* writes:

"During the last sixteen or seventeen years, the Dutch government have been carrying on a more or less active war with certain tribes in Acheen, a district of Sumatra, the third largest island of the world, and with this view have dispatched a military ballooning contingent, under the direction of Mr. Percival Spencer, an English aeronaut, to Kota Rajah, the fortified capital of the unconquered regions, where it is proposed to establish a permanent balloon reconnoitering corps to watch and, if possible, circumvent the strategical movements of the enemy. A preliminary trial ascent having been made by Mr. Spencer, in company with Major Haver Droeze, of the Dutch Royal Engineers, and in the presence of Colonel Van Zuylen, in command of the Engineers, and the highest military authorities in Batavia, and found satisfactory, no time has been lost in sending the expedition to the seat of war, and it will be interesting to learn the result of the experiment. Mr. Spencer's balloon is almost spherical in shape, with a capacity of 15,000 feet. The cable by which it is attached to the earth is made of hemp, and is 400 meters in length, while the gas used for its inflation is manufactured by portable apparatus of his own invention. The climate of Sumatra is admirably suited for ballooning observations, as dead calms prevail, and there is no mist to intercept the view of the land beneath."

NOVEL LACE OR EMBROIDERY HOLDER.

The engraving shows a simple and efficient device for holding and displaying lace, embroideries, insertions, braids, and similar goods, and for handling such goods for sale.

The holder, as will be seen, consists of a wire frame with inset ends upon which the material is wound. The joint at the ends of the wire is completed by a metallic plate, which is bent over the two branches of the wire, and the intermediate edges of the plate are bent over toward each other, forming a receptacle for a price ticket or for other memoranda. A cross wire or keeper bar, furnished at one end with an eye for receiving



LACE OR EMBROIDERY HOLDER.

one side of the frame, and at the other end with a hook for engaging the opposite side of the frame, is provided for preventing the unwinding of the lace or other material.

This device is new, simple and cheap, and well calculated for the use to which it is applied.

Further information regarding this invention may be obtained by addressing the inventor, Mr. W. C. Quigley, Lake Geneva, Wisconsin.

A Great Loom Suit Ended.

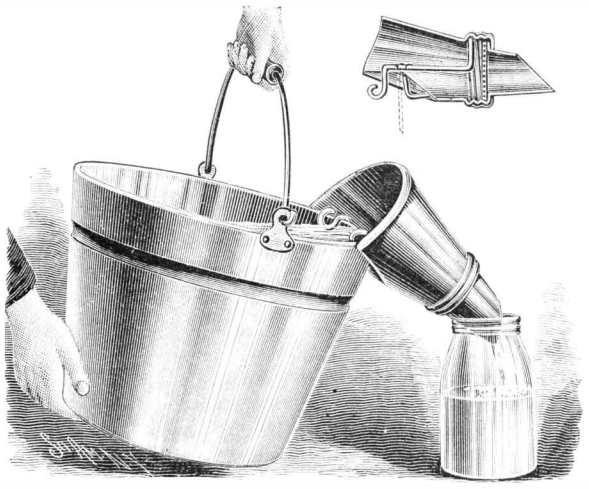
The suit brought by the Webster Loom Company against E. S. Higgins & Co., the carpet manufacturers, has been decided recently in the United States Circuit Court in this city. It has been pending since 1874, and by the terms of the decree the plaintiffs are entitled to only six cents damages. The first move was made before the Supreme Court of the United States, on an appeal by the Webster Loom Company from the decision of the Commissioner of Patents that the company's patent was invalid. The Webster Company won this suit, and the case was sent to the circuit court to determine the amount of damages due them for the infringement of their patent.

The original claim was $30,000,000, the Webster Company declaring that E. S. Higgins & Co. had, by use of the infringing device, prevented others from using their patent, and thus destroyed the market. The royalties lost by this were alleged to be about $30,000,000. Afterward the Webster Company reduced the amount of their claim to something over $2,000,000, which they charged was the amount of profit made by E. S. Higgins & Co. The machinery in dispute is known as the "wire motion," and contains a device for inserting and withdrawing the wires which form the "pile" in tapestry carpets.

Last year the master to whom the case was referred to estimate damages, John A. Shields, rendered a report allowing nominal damages to the Webster Loom Company. This was excepted to by the plaintiffs, and the exception argued before Judge Shipman, who reversed the decision of the master on technical points of law. The defendants secured a reargument before Judges Wallace and Shipman, which resulted, as before mentioned, in a decision confirming the master's report, and allowing nominal damages, namely, six cents.

COMBINED STRAINER AND FUNNEL.

We give perspective and sectional views of an improved strainer and funnel recently patented by Mr. Otto E. Lake, of Topsfield, Mass.



LAKE'S COMBINED STRAINER AND FUNNEL.

The body of the funnel is made in two parts connected together by a spun or pressed screw joint, which also clamps the strainer in place. The mouth of the funnel is adapted to fit the side of the pail, near its rim, and the funnel is held at the required angle by a bracket attached to the upper part of the funnel and adapted to bear against the side of the pail. Above the screw joint in the upper part of the funnel is formed a circumferential groove into which is sprung a wire, the outer ends of which are curved to form spring hooks to catch upon the rim of the pail and hold the funnel securely in the position of use. The lower end of the funnel is tapered and cut away obliquely to facilitate the discharge of the milk or other liquid.

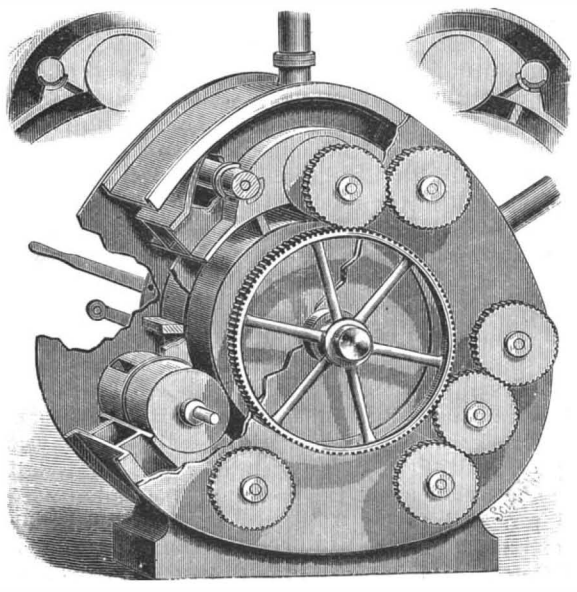
The funnel when attached to the pail in the manner described, can be used until the pail is emptied, without readjustment. The screw joint which clamps the two parts of the funnel together permits of readily taking the funnel apart for cleaning.

Further information in regard to this invention may be obtained by addressing the inventor as above.

IMPROVEMENTS IN ROTARY ENGINES.

The novel rotary engine illustrated by our engraving is the invention of Messrs. Samuel J. Holt and Daniel Kinney, of West Plains, Mo.

This engine is provided with a rotary piston furnished with a central circumferential groove into which projects a flange from the interior of the cylinder, practically dividing the cylinder into halves, each half containing a rotary piston. Each piston carries wings which are fitted to the interior of the cylinder, and at three points in the circumference of the cylinder are arranged rotary abutments which are adapted to pass the wings as the piston turns. The rotary abutments receive motion from a spur wheel on the main shaft of the engine, and rotary valves on either side of the abutments control the supply and exhaust of the steam. Each division of the cylinder is provided with throttle valves, and all of the throttle valves are operated by a system of levers connected with a single wheel or circle,



NEW ROTARY ENGINE.

which, being turned, operates all the valves simultaneously. By means of this construction, also, the engine may be reversed. The details of the rotary valves and of the abutments are shown in the small views in the upper part of the figure.

This engine is very simple, and as all of its parts are rotary, it must necessarily run in balance.

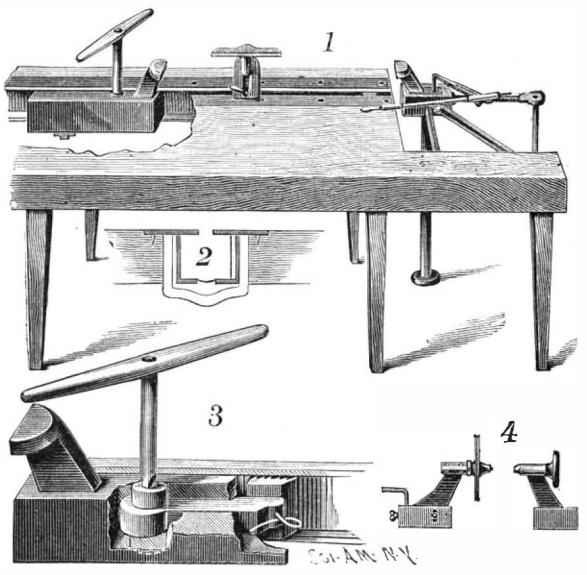
Railroad Earnings.

The gross earnings of 154 railways operating 88,560 miles of road for the month of August, 1890, according to statistics collected by the *Financial Chronicle*, are $40,634,120, as compared with $39,052,895 for the corresponding month of 1889, an increase of 4·05 per cent. The per cent increase is much smaller for August than for any other month of the current year, it being less than one-half that for June, the next smallest. A considerable number of the larger roads show losses. Considering the roads by groups, the Southern roads lead all others in the general favorable character of their earnings. Of the Southwestern roads, the Atchison, Topeka & Santa Fe and the Denver & Rio Grande show large gains, as heretofore, and several of the other lines also show improved results. On the other hand, the Chicago, Rock Island & Pacific shows a loss of $165,953, and several of the other lines have losses of greater or less amounts. The Northwestern lines, with one or two minor exceptions, exhibit increases. The Middle Western group shows more decreases than any other. This is attributed largely to the short winter wheat yield, and in the case of the New York Central & Hudson River Railroad and tributary lines, to the recent strike.

A NOVEL VISE.

The annexed engraving illustrates a new vise recently patented by Mr. George H. Squier, of Trempealeau, Wisconsin, which is adapted to a large range of work, and is also convertible into an efficient lathe.

In the work bench to which this improvement is applied is formed a longitudinal slot, the sides of which are lined with channeled iron bars, as shown in Figs. 1 and 2. The bar at the front of the bench is serrated, and to the space between and within the channeled bars is fitted a sliding block carrying one of the jaws of the vise. In the block is journaled a cam or eccentric, adapted to reciprocate a serrated jaw which engages the inner surface of the serrated channel bar. To the



SQUIER'S IMPROVED VISE.

eccentric is fitted a key with a cross arm which may be inserted whenever it is desired to revolve the eccentric and thus move forward the jaw. In this movable block is inserted one of the jaws of a vise. The other jaw of the vise is supported by a standard at the end of the bench, and is adjustable by a screw. The jaws are both removable, and may be replaced by jaws of other forms and by other attachments.

The inventor has provided a lathe head and tail block, shown in Fig. 4, which may be used in place of the jaws, and the tool rest shown in Fig. 1 may be used in connection with the head tail block, for turning wood or metal, or for boring or light sawing.

This invention will prove useful to all wood workers, and may be used advantageously by workers in metals.

Liquid Gutta-Percha.

This useful preparation is to be found in the United States Pharmacopœia, and is made thus: Gutta percha in thin slices, 1 oz.; chloroform, 8 fl. oz.; carbonate of lead, in fine powder, 1 oz. Add the gutta-percha to 6 fl. oz. of the chloroform in a stoppered bottle and shake them together frequently until the solution has been effected. Then add the carbonate of lead previously mixed with the remainder of the chloroform, and, having several times shaken the whole together, set the mixture aside and let it remain at rest until the insoluble matter has subsided. Lastly, decant the clear liquid, and keep it in a well-stoppered bottle. One part of this solution in 10 by weight of chloroform produces an excellent and convenient preparation for painting over cuts or wounds. It readily acts as a styptic and protective to the wound, and causes neither tension nor pain. If pure iodoform be added, about 10 per cent, it further enhances the value of the styptic, and can be used in veterinary surgery with marked success for applying to cuts and abrasions, as it arrests hemorrhage, forms a coating over the wound, and promotes a healthy cicatrization.

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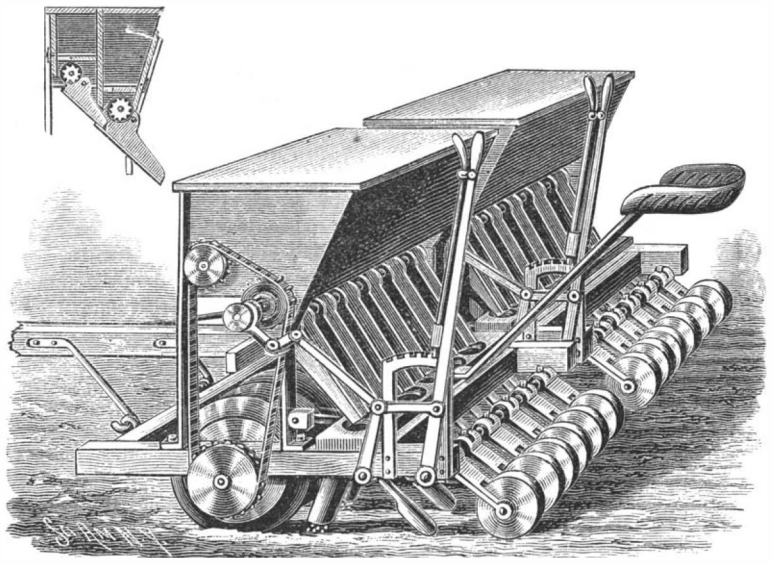
A NEW AGRICULTURAL IMPLEMENT.

In the roller and drill shown in the annexed engraving are combined two efficient implements, which taken together enable the farmer to sow seed in even drills upon either smooth or rough ground. The main frame of the machine is mounted upon the journals of a roller formed in two sections, the periphery of the roller being furnished with circumferential V-shaped ribs, which serve to pulverize the soil and at the same time form the drill for the reception of the seed.

Above the roller are supported seed boxes, each of which in the present case is divided into two compartments by a longitudinal partition, as shown in the detail sectional view, so that both seed and fertilizer may be sown simultaneously. The seed boxes are provided with openings closed by slides for supplying the seed to peculiar feed wheels, which cause a uniform discharge through the troughs, which are inclined downwardly and rearwardly to the drill teeth.

Behind the drill teeth are supported a series of slotted, concave covering blades for throwing the soil over the seed, and behind the blades, and in the path of the ribs of the roller and the drill teeth, are journaled series of rollers for compacting the earth above and around the seed. These rollers are adjustable by the levers seen at the rear of the machine. A seat is provided for the driver. Behind and above the ribbed rollers is journaled a zigzag bar which may be brought into engagement with the periphery of the rollers whenever it becomes necessary to clear them from adhering soil.



JONES'S COMBINED ROLLER AND DRILL.

It is obvious that this improved machine may be used upon either rough or smooth ground with equal facility. If desired, the rollers, the covering blades and the drill teeth may be removed, and the rollers alone may be employed for pulverizing the soil.

Further information in regard to this invention may be obtained by addressing Mr. Harvey E. Jones, of Carlysle, Ill.

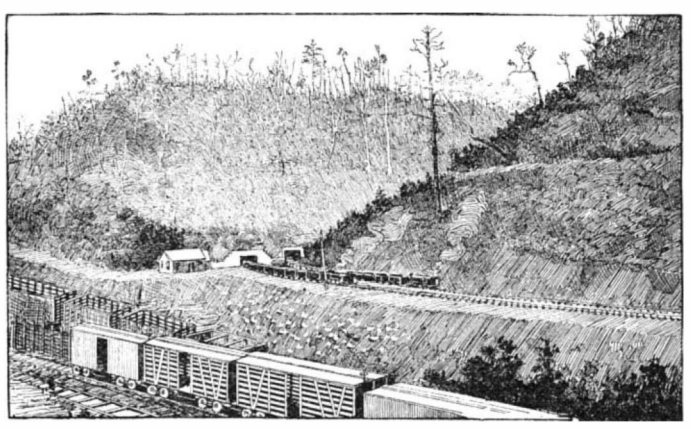
Regularity of Habit.

One of the most difficult of all minor habits to acquire, says an able writer, is that of regularity. It ranks with that of order. The natural inclination of most persons is to defer until the last possible moment, or to put off to another time, where this can possibly be done. Yet habits of regularity contribute largely to the ease and comfort of life. A person can multiply his efficiency by it. We know persons who have a multitude of duties, and perform a vast deal of work daily, who set apart certain hours for given duties, and are there at the moment and attend rigidly to what is in hand. This done, other engagements are met, each in order, and a vast deal is accomplished, not by strained exertion, but by regularity. The mind can be so trained to this that at certain hours in the day it will turn to a particular line of duty, and at other hours to other and different labors. The very diversity is restful, when attended to in regular order. But let these run together, and the duties mix, and what before was easy is now annoying and oppressive, and the exact difference between many is at this point. There are those who confuse and rush, and attempt to do several things at once, and accomplish little, while others will quietly proceed from one duty to another, and easily accomplish a vast deal of work. The difference is not in the capacity of the two, but in the regular methods of the one as compared with the irregular and confused habits of the other.

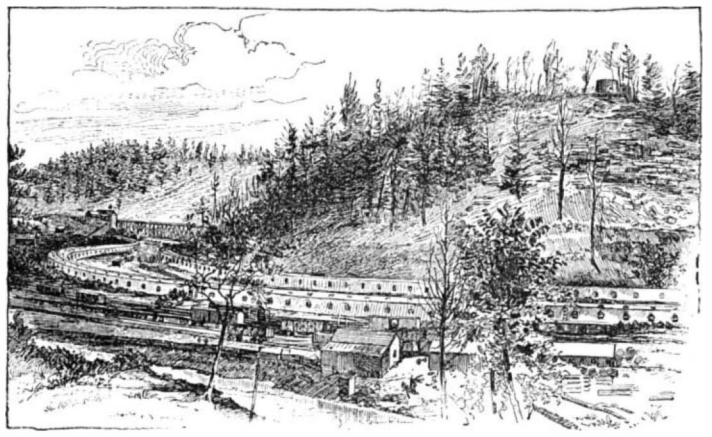
SOME OF THE INDUSTRIES OF VIRGINIA.

We present views of some of the coking works of Virginia, the cuts being kindly furnished by the Norfolk and Western Railroad Company.

The remarkable Pocahontas coal fields are well known throughout the country. The area of these steam and coking coal beds extends through Tazewell County, Virginia, and Mercer, Wyoming, McDowell and Raleigh Counties, West Virginia. The Pocahontas coal exists in three workable bed or veins, above water level; that which is chiefly worked being known as No. 3, and having a thickness in the vicinity of Pocahontas of 11 ft. 3 in. It has been estimated that this vein should yield 10,000 tons per acre, while those above it should produce each 6,000 tons additional. The almost unrivaled quality of this coal for steam-making purposes is now a matter of general knowledge. As compared with samples from five of the leading coal districts of Pennsylvania and one from Wales, it stands highest in fixed carbons and lowest in ash, sulphur and volatile matter. Fourteen corporations and firms are now engaged in coking operations in this field, running a total of 1,765 ovens, with 247 additional ovens under construction, and about 700 contemplated to be built, as the requirements of coke for furnaces demand. To these others are constantly being added. The relative value of this coke product, as compared with that used at the furnaces of the Alabama, Tennessee and Pennsylvania (Connellsville) iron-making districts, is shown in the fact that the percentage of sulphur and ash in the Flat Top coke is very much lower, and the percentage of fixed carbon very much higher than those of either of those districts. The total output of coal from this region for 1889 was 1,785,292 net tons, and the coke production was 312,310 net tons.



COAL MINES AT POCAHONTAS, VA.



COKE OVENS AT POCAHONTAS, VA.

COAL MINE AND TIPPLE ON THE BLUESTONE, W. VA.

COKE OVENS ON THE BLUESTONE, W. VA.

Cholera in Japan.

Advices reveived from Tokio, *via* Yokohama and British Columbia, contain intelligence of the terrible outbreak of cholera which has taken place in Japan, by the ravages of which upward of 200 deaths were occurring daily. Cholera first broke out in Nagasaki, the southern metropolis of Japan, and in twenty days there were 926 cases and 671 deaths. The disease quickly spread, and by the 29th of July all the towns from Satsuma to Hakodate were attacked, the deaths per day being estimated at not less than 200. At Yokohama the outbreak was not very serious, but the officers and crew of the Turkish war ship Ertogrul were attacked and the vessel was removed to the quarantine grounds, where two seamen died. Her Majesty's ship Imperieuse left the harbor to avoid the epidemic, and the captains of the English, American, and other merchant vessels in port were adopting every precaution to protect their crews.

Treatment of Diphtheria by Inoculation.

In the *Repertoire de Pharmacie* for July 10, 1890, it is stated that Dr. Babchinski was attending a case of grave diphtheria occurring in his own son, in which a rapid change for the better occurred coincidentally with the appearance of erysipelas on the face. The fever rapidly fell, the false membrane disappeared, and cure rapidly took place. Dr. Babchinski also states that in several other cases he noted a great improvement coincident with the appearance of erysipelas, and in one of them the erysipelas occurred on the leg and not on the face. These facts suggested to Dr. Babchinski the idea of inoculating diphtheria cases with blood taken from patients suffering from erysipelas, and he states that in several cases in which he employed this procedure cure resulted. Later on he practiced inoculation of other cases of diphtheria with cultures of the microbe of erysipelas in agar-agar, and likewise noticed the disappearance of the symptoms of diphtheria. He further adds that when the inoculations were made all special treatment was suspended, and in no case did the erysipelas present any sufficient gravity to cause uneasiness. He concludes by stating that, if his observations and experiences are confirmed, this treatment should rob diphtheria of all its dangers.

MR. CHARLES BELL, of Stroudsburg, Pa., sends a photograph of a part of a collection of moths, beetles, and other insects killed by arc lights. The specimens are artistically grouped and represent a large number of species. Mr. Bell says the number of insects destroyed in this manner is very great, some nights amounting to more than a bushel.

FILLING FOR DRY BATTERIES.—A new mixture for filling dry cells prepared by Mr. A. V. Meserole, of this city, consists of the following solid ingredients in the form of powder: Charcoal, 3 parts; mineral carbon or graphite, 1 part; peroxide of manganese, 3 parts; lime hydrate, 1 part; white arsenic (oxide), 1 part; and a mixture of glucose and dextrine or starch, 1 part; all by weight. These are intimately mixed dry and then worked into a paste of proper consistency with a fluid solution composed of equal parts of a saturated solution of chloride of ammonium and chloride of sodium in water, to which is added one-tenth volume of a solution of bichloride mercury and an equal volume of hydrochloric acid. The fluid is added gradually and the mass well worked up.

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The Utilization of Niagara Falls.

A contract was awarded on September 13 to Rogers & Clemens, of this city, to construct a tunnel parallel to Niagara River for the Cataract Construction Company. The consideration involved is not announced. A bond in the sum of $300,000 has been executed by the firm. Work will be commenced immediately, and must be finished in January, 1892. In 1886 the Niagara River Hydraulic Power Server Company was incorporated by a special act of the State Legislature. At various times the charter was amended and the name finally changed to that of "The Niagara Falls Power Company." In July, 1889, this company awarded the Cataract Construction Company the contract to construct at Niagara Falls works which will develop 119,000 horse power. Since that time the contractor has been preparing plans and specifications for the work. The sub-contract just awarded is the first decided move which proves to the public that the preliminaries are nearly finished, and that it is certain the works are to be built. At the present time the contractor has a commission in Europe studying plans of plants of a similar nature, with a view of ascertaining the most practical method of constructing the Niagara plant. Up to date plans for any portion of the plant, excepting the tunnel, have not been adopted. Consequently the manner of connecting the tunnel with the upper river is not known. There will, however, be a canal either with or without a series of transverse surface conduits, which will conduct the water to penstocks and thence upon turbine wheels. The tunnel, which is to be merely a tail race, will receive the water from the turbines conducting it below the falls. The details upon which this tunnel is to be constructed are at hand. It is to start at a point below the falls under the suspension bridge, extending through the rock to the upper river to a point 6,700 feet from its mouth, where a head of 120 feet will be obtained. It will be 28½ feet high, 18 feet wide, with a semicircular top of 9 feet radius, and straight sides. The fall will be 36 feet to the mile.

The company owns 225 acres of land along the river suitable for mill sites, 75 acres under water adjacent to said land, and 1,100 acres lying back from the river about midway between La Salle and Niagara Falls. It has been estimated that the flow of water over the falls amounts to 12,785,455 cubic feet a minute. To develop 119,000 horse power with a 120 foot fall would require but one-fifth of one per cent of this volume. From these figures it will be seen that the power is almost inexhaustible. If this plant, soon to be constructed, proves to be a success—and there is no reason to believe that it will not—the power now running to waste, reaching a figure almost beyond the comprehension of the mind, can be utilized by additional plants of a similar nature. —*Eng. and Min. Jour.*

The Coloring of Metals.

In a recent issue of the *Zeitschrift des Vereines Deutscher Ingenieure*, Herr S. Stein gives the results of some experiments relating to the coloring of metals when annealing, which he shows is due to oxidation of their surfaces. In these experiments pieces of iron and steel were carefully cleaned with alcohol and ether, and put into a glass tube; the air was exhausted and replaced with pure nitrogen, which also was pumped out in order to secure a thorough removal of the oxygen. The tube was then gradually heated, and as the hydrogen and nitrogen generated from the metals they were pumped out. The inner surface of the tube, on its cooler parts, became covered with a white precipitate of a still unknown nature. The whole scale of the temperatures appropriate for the appearance of the annealing colors was tried, but these failed to appear, whereas they were called forth immediately on the admission into the tube of air with oxygen. Herren R. Schwirkus and F. v. Lichtenstein have demonstrated in an experimental way that an increasing hardness of the steel necessitates an increasing heating to produce the same annealing color, and that the composition of the steel affects the conditions for the appearance of the different colors in a still higher degree than the hardness. The combinations of temperatures and colors in the ordinary methods are thus entitled to only conditional correctness at best. Another series of experiments relating to the influence on the colors of the duration of the heating manifested that they can appear at even very low temperatures if they are only kept up long enough, and that the difference between hard and soft steel asserts itself here too. A soft piece exposed during several days to the heat of 177 deg. C. showed purple after 68 hours, violet after 93, and dark blue after 120, whereas a glass-hard piece turned light yellow after 20½ hours, dark yellow after 27, orange after 50, and purple after 103. At higher temperatures the colors appeared with shorter intervals.

L. S. GRAVES & SON, of Rochester, N. Y., manufacturers of passenger and freight elevators, are just completing two first-class elevators, one for the new fireproof building of the Bank of Commerce, Tacoma, Washington, and one for the Fair Haven Hotel, Fair Haven, in the same State.

The Longevity of Trees.

It is generally admitted that European trees have rarely exceeded the very respectable age of 800 years. Thus, recent information gathered by the German Forestry Commission assigns to the pine 500 and 700 years as a maximum, 425 years to the silver fir, 275 years to the larch, 245 years to the red beech, 210 years to the aspen, 200 years to the birch, 170 years to the ash, 145 years to the alder, and 130 years to the elm. The heart of the oaks begins to rot at about the age of 300 years. The holly oak alone escapes this law, and there is a specimen of this aged 410 years in existence near Afschafenburg in Germany.

At the Edinburgh Forestry Exhibition, four years ago, there were exhibited two transverse sections of a couple of Scotch firs. One of these, which was 7¼ feet in diameter, was 217 years of age; the other, which was but 5¾ feet in diameter, was older, and exhibited 270 annual rings. A *Sequoia gigantea* felled in Calaveras County, California, measured 387 feet in height, 3.25 feet in diameter at the base, 15 feet at 125 feet above the earth, and had attained the age of 3,000 years. At Caphyoe (Arcadia) may be seen a plane tree which for a long time was regarded as the one that the historian Pausanias spoke of in the second century.

There is a cypress in the vicinity of Padua which is regarded as having been a contemporary of Julius Cæsar, and according to another and more plausible legend, it was against the trunk of this tree that Francis I., seeing "all lost save honor," endeavored to break his sword. The oak of Swilcar Lawn in the forest of Needwood was still robust in 1822 at the age of 600 years, and, at the same epoch, there might have been seen at Chupstead Place, County of Kent, a large elm, around which a fair was annually held during the reign of Henry V., in the fifteenth century.

The age of the Braburn yew, in this same county of Kent, was estimated by De Candolle to be 3,000 years, and he attributed the same age to another yew, that of Fortingal, in Scotland. The English historian Evelyn, in the seventeenth century, cited a linden of the environs of Neustadt (Wurtemberg) then aged more than 1,000 years.

At Hildesheim, in Hanover, there is a celebrated rose bush, the oldest in the world. Charlemagne himself planted it more than a thousand years ago in commemoration of the embassy received from the caliph of the Thousand and One Nights, Haroun al Raschid. In 818 Louis le Debonnaire, son of Charlemagne, had a chapel constructed, the altar of which was placed over the roots of the rose bush. The stem of this dean of rose bushes is about 2¼ inches in diameter and 28 feet in height. The branches trained up against the apsis of the chapel cover a surface of 118 square feet. The plant annually bears a large number of flowers.

In addition to the celebrated linden of Morat in Switzerland, several specimens of this tree are cited as having reached a more advanced age. One may be seen not far from the church of Cadier in Keer, in the province of Limburg, whose trunk measures about 20 feet in circumference. It is said to have been planted by the Roman soldiers who were besieging the neighboring city of Attnatica, now Horstens. A violent storm broke off a portion of its branches in 1868, and the debris amounted to six wagon loads. Some years later its top suffered greatly from a fire that consumed the houses in the vicinity; but, despite these two accidents, the tree is still vigorous, and it shades a vast surface. There is to be seen also at Schwarzenberg, in Saxony, a linden whose trunk is 25 feet in circumference, and two others at Schneeberg, one 16 and the other 14 feet in circumference.

The oldest known conifer of Germany, a fir, has recently been felled at Grunnthal, Saxony. It measured 7 feet in diameter at 5 feet above the ground. The ancient acts and charters often mention trees selected as boundaries of property. Thus, a chestnut tree of Tortworth, England, whose trunk is formed by the adhesion of two trees, figures upon a charter dated 1135. An oak still living at Tilford, near Farnham, is mentioned in a charter of Henry of Blois under the date of 1250. A hawthorn in the vicinity of Norfolk, long known as the Hethel thorn, is the old thorn spoken of in an act of 1200.

An American journal, the *Weekly Press*, of Philadelphia, recently gave some statistics as to the largest trees in the United States. Excluding the sequoias, it cites: An oak in Marion County, Florida, whose trunk measures 31 feet in circumference, with a spread of branches 138 feet in diameter; a sugar maple in Bradford County, Pennsylvania, 16 feet in circumference, with a branching of 85 feet in diameter; a chestnut tree in Lancaster County, Pennsylvania, 25 feet in diameter, and with a spread of branches 88 feet in diameter; a sassafras 46 feet in height and 13 feet in circumference at Johnsville, Pennsylvania; a sycamore 28 feet in diameter in Wabash County, Illinois; and an apple tree 112 years of age, still bearing fruit, at Boothby, Maine. The dean of trees of the Eastern United States, the Woodbridge oak, was felled a few years ago in the vicinity of Boston. Prof. Abbott, of New York, estimated its age as 2,000 years, and Prof. Eaton as from 1,500 to 2,000. During the war of independence, Lafayette's army, marching through Woodbridge, rested beneath the shade of this venerable tree, the remains of which were used by the members of the Quinnipiac Club, of New Haven, to make seats of.—*Revue des Sciences Naturelles Appliquées.*

The Memory for Names.

At a recent session of the Biological Society, Mr. M. Duval presented a communication with the following title: "Some Facts Relative to a Peculiarity of the Memory: the Inhibition Exerted by Certain Visual Images upon Other Visual Images." These facts are connected with the memory for names, and will interest many of our readers.

"I have," says the author, "great difficulty in recollecting proper names, the names of persons. But I have gradually found that this poor memory for proper names is not the same for all names, and that it is submitted to a law whose absolute signification I recognized as soon as my attention was directed toward determining it.

"My memory is never at fault for the names of persons whose countenance I have never seen. However difficult or complicated, for example, be the names of foreign anatomists, German or others, I retain them and easily recall them whenever necessary, provided I have never had an opportunity of seeing those who bear the names. On the contrary, I am always at a loss to recall the names of persons with whom I am most familiar, whose names I hear pronounced or daily have to pronounce. In these cases, when I wish to recall such a name, it is the image of the face, the image of the person even, that presents itself to my memory, and with such an intensity that this image seems to obscure that of the name. So, too, when I suddenly see a face, that of a well known person, the very fact of looking at it prevents me from recalling the name.

"I have been led to this interpretation by the following fact: A few years ago, I would never have failed to recall the name of Kolliker at the moment desired. I knew the eminent anatomist only by his works. Of his individuality I had no other visual image than that of his printed name. Having had the honor of making his acquaintance, my memory became enriched with the visual image of his person, of his countenance. Suddenly, after this, the singular fact occurred that when I had to recall his name, it was the image, the recollection of his countenance, that presented itself exclusively, and the image of his name did not reappear. Put on the alert by this first observation, I have repeated it a great number of times in various analogous cases, and have acquired the conviction that there is a true inhibition exerted by the reviviscence of the image of the face upon the representation of the image of the name.

"Some years ago, being called upon to preside at the meetings of the Biological Society, I was sorely surprised, when a colleague asked to be heard, that I could not designate him by name. The sight of his face—of his person—at this moment effaced the image of his name by the very intensity of the impression. More recently, in presiding over the Anthropological Society, I have remarked the same thing and completely analyzed the phenomenon.

"In order to point out precisely the import of it, I must add that I have always had an excellent visual memory for things, places, and countenances, recognizing after a long interval a person who had been seen but a few instants, and finding my way again in places that I had taken but a glimpse of in passing. Now, from the moment that a figured object had engraved its image upon my memory, the reviviscence of such image rendered that of the name difficult. Now with age it seems to me that my recollection of forms, places, and faces is becoming a little less vivid; parallelly, my memory for names seems to be becoming better. This is because the first images, becoming less impressive, no longer exert so energetic an inhibition upon the second. I have never hesitated to recall an abstract word. This is because there is here no image of the thing coming to substitute itself for that of the name."

The phenomena mentioned by Mr. Duval are perhaps quite frequent. It is easy for any one to verify them upon himself. Such a study may give rise to curious observations.—*La Nature.*

Exploration of Alaska.

A bill introduced in the House of Representatives provides that the Secretary of War be authorized to send an expedition to the interior of Alaska for the purpose of making a thorough exploration and survey of that Territory, with a view of ascertaining its resources and capabilities. It is proposed that the party sent out should locate near the center of the Territory, and from that point as a base push expeditions into all parts of the interior. The party is to remain not less than three years. In this way a thorough knowledge of the topography and other features of the country may be gained. An appropriation of $100,000 is asked.

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Correspondence.

The Giffard Gun.

To the Editor of the Scientific American:

I was glad to see the description of the Giffard gun published in the *Revue Industrielle*, for July 10, reproduced in your paper of August 16, but I wish to call your attention to an error which should be corrected.

The pressure of the carbonic acid at 30 deg. is 70 atmospheres, not 10 atmospheres, and it is with this pressure of 70 atmospheres that the calculation is made which gives about "30 kilogrammeters" (as mentioned in my description) as the maximum theoretical work of the expansion of a gramme of liquid carbonic acid. It should be "about 30 kilogrammeters," and not, as translated, "one-thirtieth of a kilogramme." J. R.

Cutting Glass Bottles.

To the Editor of the Scientific American:

From the question, how to cut glass bottles, and the two answers, I infer that neither of these gentlemen is acquainted with a very easy method which I practiced thirty or forty years ago many and many times.

This method consists in the use of what in German is called "sprengkohle," cracking coal.

The "sprengkohle" is made of finely ground lime-wood charcoal. The coal powder is transformed by means of sufficient gum tragacanth and water into a dough or paste, out of which small cylinders of the size of a pencil are made by rolling between two small pieces of board. Such a cylinder of "sprengkohle," ignited at one end, glows slowly. Such "sprengkohle" may be bought at stores for chemical and physical necessities.

Now as for the use of the "sprengkohle." It is as follows:

Put a drop of water on the spot where the crack is to begin. Make a short incision with a three-edged file. Wipe the water away. Touch the incision with the glowing "sprengkohle," blowing on it if required. After a few seconds the glass will crack for a length of ¼ to 1 inch. If now you move slowly the "sprengkohle," the crack follows it wherever you please.

By that means I made a great many pneumatic bells, by cutting off the bottom of great bottles, from 6 to 8 liters, and closing the neck by plaster of Paris.

For joke's sake I once cut or cracked a medicine bottle, of half a liter, spirally in such a way. If that bottle was lifted by the neck, it prolonged itself by its weight for about half an inch. If it was filled with water, and somebody caused to lift it by the neck, instantly its contents overflowed the table. WERDMULLER.

Vienna.

A Belt Problem.

To the Editor of the Scientific American:

A practical man has recently criticised a "theorist" who says a double belt will do most work when not cemented or riveted together.

This reminds us of an experience we had with a double belt several years ago. We ran a lathe which had a single leather belt. It lacked driving power, and we laced another belt of same width on top of this. The pulling power was increased, and was all we desired; but the two belts were hard to shift from one pulley to another. In doing this the bottom belt would often get on top, so we riveted them together, placing copper rivets about a foot apart. The lathe was started, and when stopped a short time afterward we were greatly surprised to find that all the rivets were pulled through the holes in the under belt and hung loosely in the outer one. They were not near the holes in which they had been placed. The fact was clear that the outer belt had been *creeping* on the inner one, and that, too, with tremendous power. We examined, and found the distance traveled by the outer belt in excess of that by the inner one was less than an eighth of an inch for each complete circuit.

Query: Do all double belts, whether cemented and riveted or not, have the same tendency to creep? and if so, does a futile effort to do so absorb power? Then again, what is the cause of this creeping?

There may not be much of importance in these questions. Yet some of your many readers may feel an interest in the subject. QUIRK.

To Destroy Stumps.

1. Bore a hole 1 inch in diameter, 18 inches deep, into the center of the stump, and put in 1 ounce of saltpeter, filling up with water and plugging up the hole. This should be done in the fall. In the spring the plug is to be taken out, a half a gill of kerosene poured into the hole and set on fire. It will burn out the stump to the farthest root.

2. In the fall bore a hole 1 inch in diameter, 10 inches deep, into the center of the stump, and put in a half pound of vitriol and plug very tight. In the spring the whole stump and roots through all their ramifications will be so rotted as to be easily removed.

[SAW-MILL GAZETTE.]

How to Manage a Steam Engine.

A PRIZE ARTICLE.

BY ECCENTRIC ROD.

(*Continued from page* 200.)

THE GOVERNOR.

The governor I watch closely, and pack as loose as I possibly can, so that the balls will have no more resistance to overcome than necessary. Keep the stem through the stuffing box well oiled, belt just taut, everything clean, and it will work if it is a good one. The joints must not be worn any to insure perfect working.

About lubricating cylinder, I prefer a pump to anything I have seen, this to be attached to steam pipe between the throttle and governor, and then the governor valve, slide valve and piston get the benefit. With the small hand pump you are sure of getting oil just when you want it, and just the amount required. I don't like tallow for cylinder. It has an acid which will attack iron and eat it. There is a difference in opinion about oiling cylinders at all. I have run two fine-working engines that never had any oil on any part of cylinder.

If the new engine can be used carefully until the lathe tool marks can be changed to lengthwise marks, without cutting, I think it will run easily without much oil, but new iron is like blotting paper—if it gets oil before the polish gets on the cylinder, it will spread all over and through the iron, and the polish comes slow.

I have named many things that are found only in part on the majority of engines and boilers, but if I intended to run an engine any length of time, I would try to have them, as I know, handling carefully as you may, there is always some danger, and when I know that water will expand about one thousand seven hundred times by heat, I will use every precaution to prevent it coming in contact with overheated tubes by low water, or by allowing scale or dirt to settle on tubes or shell, so water will be separated from the iron. The iron has to be heated much more, as the scale is a poor conductor of heat, and when it gets thick it may be lifted off by intense heat, and of course let water down on the too hot iron.

THE BOILER.

The boiler I started out with, forty-two inches in diameter, exposes about one thousand three hundred and eighty-four inches of surface, minus the amount of the tubes; and with sixty pounds steam pressing on every inch, I can realize that it must have care to make it hold this safely, and if I find anything around the boiler in the way of leak, blister, or anything that I know to be in any way dangerous, I will notify the owner, and it will have to be fixed immediately, or he will be compelled to get another engineer. I saw recently what was left of a boiler which exploded, caused, as per inspector's report, by low water. The engineer said that he knew the boiler was unsafe and the tubes were leaking. I may have had unusually good rigs to handle, or I may know something about taking charge. However, I have been running and handling every kind of boiler, excepting locomotive, for eighteen years, and I have never had a leaky boiler from my management, leaky tubes, or other trouble with engine that ever occasioned stoppage thirty minutes at a time. Attention to business and a love of the science (which caused me to study up points) has had something to do with my success; but at the same time, my success is not proof against accidents which happen; but all I can say is that if a man tries to keep posted, and will learn when he has a chance, and keep his eyes open to do the best and take no chances, he ought not to be blamed if accident should overtake him.

Now, Mr. Editor, this is my maiden effort as a writer, but as you called for simple points, that are usually omitted by book writers, I have tried to give them step by step, as I use them in practice, and if this article will be of benefit to any young runner, I shall be glad. I know when I first commenced, I grabbed at everything pertaining to steam; although many things I knew, I thought of them more when I found some one recommending them.

Paraguay Tea.

Paraguay tea, also called maté or yerba maté, from the name of the cup in which it is infused, consists of the dried leaves of the Brazilian holly (*Ilex paraguensis*). This plant is most extensively used in South America, and is said to possess many of the good qualities of tea, though a long indulgence in its use has been stated to induce diseases similar to those following the abuse of alcoholic drinks. In South America the tea is first placed in a maté, in which it is well shaken, a little warm water is then added, and the leaves stirred up; the gourd is then filled up with boiling water, and in a short time the liquid is ready for drinking, being stirred from time to time and more hot water added as necessary. On account of the slowness with which exhaustion occurs, care is taken to prevent the loss of the aroma by never letting the infusion cool down.

In the *British Medical Journal* for July 26, 1890, Dr. T. Cranstoun Charles writes that he has lately made several chemical examinations of this body, as he finds that the analyses published of it varied very greatly. The alkaloid present is caffeine, identical with the caffeine found in tea and coffee; there is also a tannic acid present in large amount. Comparing the analysis of maté with tea and roasted coffee, the following results were obtained:

	Caffeine. Percentage.	Tannic Acid. Percentage.	Ash. Percentage.
Tea	3·1	22·7	5·8
Roasted coffee	1·2	5 8	4·6
Maté	0·79	21·9	4·1

Both the active principles of these bodies appear to be the same, yet they seem to act somewhat differently on the system, and it should be remembered that their action is not dependent alone upon their proportion of alkaloid, but also on the presence of other bodies in small amount, such as volatile aromatic oils, empyreumatic products, and the like.

Dr. Charles made a number of experiments upon himself and a friend with the alkaloid, which he separated from the maté, the results of which we omit.

Mate appears to act as a cerebral stimulant, and also to have a special action on the sympathetic system, the contractions of the cardiac muscle being increased as well as those of the unstriped muscle of the bladder and intestine; and the whole muscular system seems to be stimulated by it to increased labor and wakefulness.

As regards the therapeutics of maté, but little has yet been determined, although Dr. Charles states that in the instance of two old ladies who were great tea drinkers, and who used to suffer much from sleeplessness, headache, and constipation, the use of maté had after a week produced great improvement. They slept well, passed more urine, their bowels became regular, and they suffered no more from headaches. It is also stated by Dr. Charles to have been serviceable in relieving patients who suffered from severe nervous headaches generally associated with constipation, and with whom tea and coffee appeared to disagree.

Hints Worth Heeding.

When a man has his business in perfect working order, and knows that, just then, a little more or a little less effort on his part will be answered by increased or decreased profits, it is hard for him to believe it wise for him to leave his duties for an hour, even though he is overworked. But one of the highest duties a man owes himself is to give his brain an occasional rest. There is a good deal more in life than simply adding to one's bank account. There is more honor in being a good citizen than in simply growing rich. It is poor policy to be thoroughly posted in all that concerns your business and be out of all knowledge of the great world. A man wants to forget his business occasionally—ought never to carry his cares beyond his store door. A night's respite from business cares will send you back to them with renewed strength and a clearer head.

Do not imagine that your business will go to the dogs if you leave it for a day or two. If you have been thorough with your men—if you have faithful and interested employes—the machine will jog along smoothly enough until you return. We are all apt to flatter ourselves that we are doing what no other person could do; but, not infrequently, something happens to show us that we are not nearly as indispensable as we imagined—in fact, that a division of labor in our business would be vastly to its advantage. Our subordinates, if left in charge, occasionally will have a chance to carry out some ideas of their own, and these, in a majority of cases, are decided improvements. The man who repulses suggestions from those under him—gives his men no credit for knowing anything beyond the steady routine of their employment—loses much that would be of assistance to him, falls into a rut and stays there, much to his detriment. The man who cannot learn something from contact with other men, whether employes or outsiders, is not a healthy man.

Business is a master that soon makes abject slaves of us if we will; but, with a well established trade, one should be master of his business. With probity, industry, and economy, almost any man, by well directed effort, may be prosperous. Whatever progress is made without this foundation is deceptive.—*Adapted from Maher's "Practical Hints."*

Modern Light and Heat estimates the capital invested in electric lighting plants in the United States has reached the enormous aggregate of $118,758,500, and there are at the present time in use 1,590,667 incandescent lights, 127,441 arc lights, and 1,379 stations. These figures tend in a measure to show the importance to which electricity has advanced within a few years. This does not consider the thousand and one applications of the element other than lighting.

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THE NEW STEAMER PLYMOUTH OF THE OLD COLONY STEAMBOAT COMPANY.

The steamer Plymouth, now in process of construction for the passenger and freight service of the Old Colony Steamboat Company, of Boston, Mass., is rapidly approaching completion. Soon after this reaches our readers the trial trip will be made, and the boat will be placed upon the line. The new steamer is not so long as the Puritan or Pilgrim. In the construction, all the features of merit developed in the building of the Pilgrim and Puritan, whose consort she is to be in the fleet comprising these vessels and the Providence, have been kept in view, while in many points new departures in construction are introduced.

In the matter of external appearance a difference from existing models is to be observed. The paddle wheels are inclosed, but not by the usual semi-circular or semi-elliptical paddle boxes. The regular lines are not disturbed.

This feature was introduced originally in the Puritan. It confers a more ship-like aspect to the vessel. The boiler furnaces all discharge into a single central smokestack. These details principally affect the design, and have little reference to the structure proper.

The general dimensions of the hull are the following:

Length on water line 351 ft. 8 in. Length over all 366 ft. Beam moulded 50 ft. Width over guards 86 ft. Depth moulded at lowest point of sheer 21 ft. Draught of water loaded 12 feet. Distance from keel to topmast head 119 ft. Distance from keel to top of house on dome deck 59 ft. 4 in.

The hull is of steel with a double bottom, the space between inner and outer skins being 3 ft.

The cross frames are of the bracket plate type, and longitudinal frames with solid webs run fore and aft. Solid web transverse frames are introduced, so that the bottom is cellular. Transverse water-tight bulkheads, six in number, are also used to make the vessel still more secure against sinking.

Two complete systems of wrecking pipes and valves are carried over the bottom. These represent suction pipes. One set communicates with numerous points between the skins of the double hull. The other set communicates with a number of points in the bottom of the hold. The systems connect with one main wrecking pump, which is a duplex Blake pump with 8 in. suction, with a donkey pump of the same make with 7 in. suction, and with a Cameron pump with 5 in. suction. The latter is devoted more especially to pumping out the inner bilge. The wrecking and donkey pumps are on the main deck, far above the water line, and can be run from the main boilers or from the donkey boiler. The latter is also placed on the main deck. Thus the steamer can never be placed in the predicament of the City of Paris, where the pumps and wrecking appurtenances were under water and inaccessible. Sea cocks with connections are provided for the same pumps, so that they can be used to extinguish fire.

The engine is of 5,000 H. P., and is the first one of its kind as regards combination of cylinders. It is a four-cylinder, triple-expansion, double-inclined engine. It has one high pressure cylinder of 47 in. diameter, one intermediate cylinder of 75 in. diameter, and two low pressure cylinders of 81½ in. diameter each. The stroke is 8 ft. 3 in. The shaft is in three sections. Each outer section carries one crank arm, to which the outer end of each of the two crank pins is keyed. These arms are the driving cranks. The central section carries the two other crank arms, to which the inner ends of the crank pins are secured, the latter section with the arms acting as the drag cranks. The cranks are at right angles. The starboard crank pin has upon it two journals and receives the connecting rods from the high pressure and from one low pressure cylinder. The port crank pin comprises three journals. The connecting rod from the intermediate pressure cylinder is journaled to the central portion; the outer journals receive the connecting rod from the second low pressure cylinder, which rod is forked at the end. Thus, for the four cylinders there are five crank pin bearings. The low pressure cylinders are placed aft of the shaft; the other cylinders are forward.

Owing to the inclination of the cylinders and the oscillation of the connecting rods, only one of the cylinders can be thrown upon a dead point at the same time. The power is therefore very well distributed, and the shaft rotates with great regularity. The weight of the cranks, etc., would tend to disturb this motion, but this is obviated by another peculiarity. The air pumps, of which there is one for each low pressure cylinder, are worked from the low pressure crosshead. As the cranks, connecting rods, etc., reach a position where their weight tends to accelerate the motion, the air pumps are working at their hardest, so that the overbalance is corrected.

The valves are double-balanced vertical poppet valves. For the high pressure cylinder an adjustable drop cut-off is used. The other cylinders have fixed Stevens cut-offs. The valves are worked by double eccentrics and links. The latter are shifted by a special steam engine.

Each low pressure cylinder has its own air pump and surface condenser, with an independent centrifugal circulating pump. The air pumps are vertical, 40 in. diameter and 30 in. stroke. The combined cooling surface of the condensers is 9,050 square feet. The condensers can be connected in case of an accident to either of the air or centrifugal pumps.

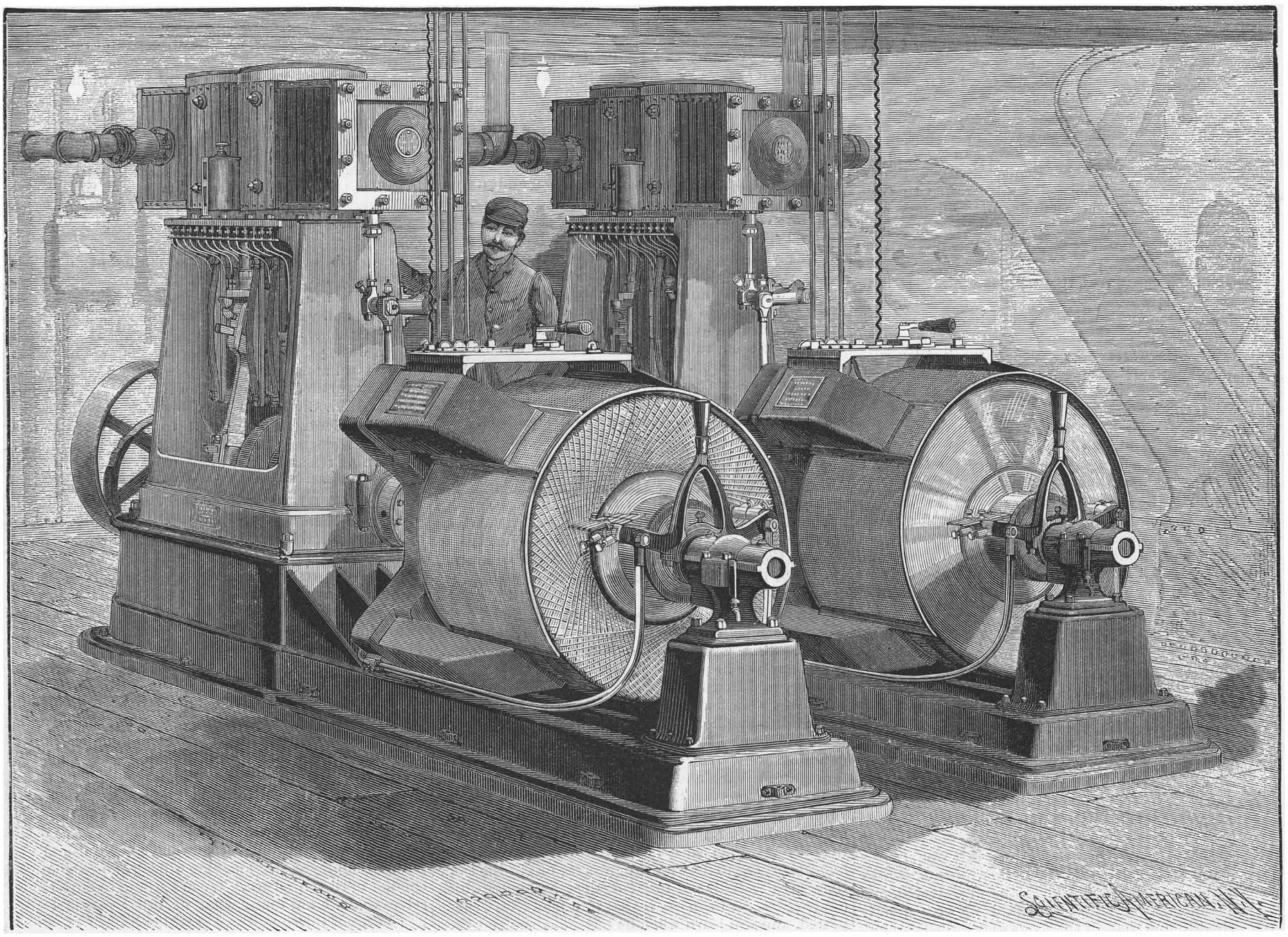
There are two independent duplex feed pumps, the suction and discharge pipes of which are connected so that either or both can be used.

The wheels are of the feathering type, 30 feet in diameter outside of the buckets. Each wheel has twelve curved steel buckets, each bucket being ⅞ inch thick, 4 feet wide, and 13 feet 3 inches long.

There are eight main boilers of the "Scotch" type. Each one is 11 feet 4 inches in diameter and 13 feet 1 inch long, made of 1 inch steel. There are two furnaces for each, of corrugated steel. They are arranged to be worked together or independently, and can be used to drive the pumps in place of the donkey boiler. Forced blast under the grates can be used if desired, as fans are supplied which can be connected for this service, and which are also to be used for ventilating the forward hold, furnace room, and engine room. The boilers have been tested up to 260 pounds pressure, giving a working pressure of 170 pounds. The maximum pressure, however, is placed at 160 pounds. The boilers are inclosed in a steel chamber to prevent the possibility of danger from fire. They are placed back to back in the center of the vessel, making two fire rooms, one on each side of the hull. The coal is contained in bins, whence it descends in chutes by gravity to the fire room. Ashes are discharged by ejectors through pipes.

The smokestack is 10½ feet in diameter, and rises to a height of 86 feet above the water line, or 98 feet above the keel.

The interior finish is very ornate. The dining room is 84 feet long, and can seat 140 people. There are 250



ELECTRIC LIGHT GENERATING PLANT OF THE STEAMER PLYMOUTH.

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staterooms, which is more than the Pilgrim contains, although the latter steamer is the longer.

The general design of the Plymouth was made by Mr. George Peirce, supervisor of the Old Colony Steamboat Company.

The contractors for the boat complete and builders of engine were the W. & A. Fletcher Co., New York.

The hull was built by the Delaware River Iron Ship Building and Engine Works, Chester, Pa., and the joiner work, including painting and plumbing, was in the hands of Wm. Rowland, New York. The designs for the decorations are by Mr. Frank Hill Smith, of Boston, Mass.

The electric lighting plant was put in by the Edison General Electric Co. under the special superintendence of Mr. W. H. Peirce, to whom our thanks are due for courtesies extended. Two dynamos, driven each by an independent compound Ball engine of 65 horse power at 120 pounds pressure, are used as generators. They are connected directly to the engine shaft, and run at 400 revolutions per minute. The field terminates in eight poles, four external, all of one sign, and four internal of the opposite sign. Within the zone marked by the eight pole pieces the armature, which is a Gramme ring, rotates. The core of the ring is of laminated sheet metal. Each dynamo has an output of 350 amperes at 115 volts potential, enough to supply 700 lamps. Each dynamo weighs 6,563 pounds, each armature 1,950 pounds, and the dynamo and engine and appurtenances about 13,000 pounds. The commercial efficiency is 89 per cent, and the heating is only 36° F. above the atmosphere. They are compound wound, and show a maximum variation in their characteristic curve of 1 volt. They are of a type conforming to specifications originally issued by the United States government.

The installation is on the two-wire system. The dynamos are connected in parallel so that one or both can be used to supply the current. From the generating plant double transit leads are taken fore and aft, and branching so as to terminate at four cut-outs. From these cut-outs the lamps are supplied directly or by feeders. The main leads are not tapped. As more work might be thrown upon one main lead than on the other, equalizing mains are carried from each forward cut-out to each of the after cut-outs. This gives four distributing points. Risers are carried through the decks to supply the lights at different elevations.

Below the main deck wherever moisture may be present lead-covered wires and water-tight brass junction boxes containing safety fuses are used. Elsewhere Habirshaw marine core wire is employed.

The staterooms are grouped in eight divisions. For each of these a marbleized slate tablet placed so as to fill an alcove transom is provided, on which the switch boxes and general branch connections are made. This is done not only for the decorative effect, but also to provide security from deterioration by moisture and from fire.

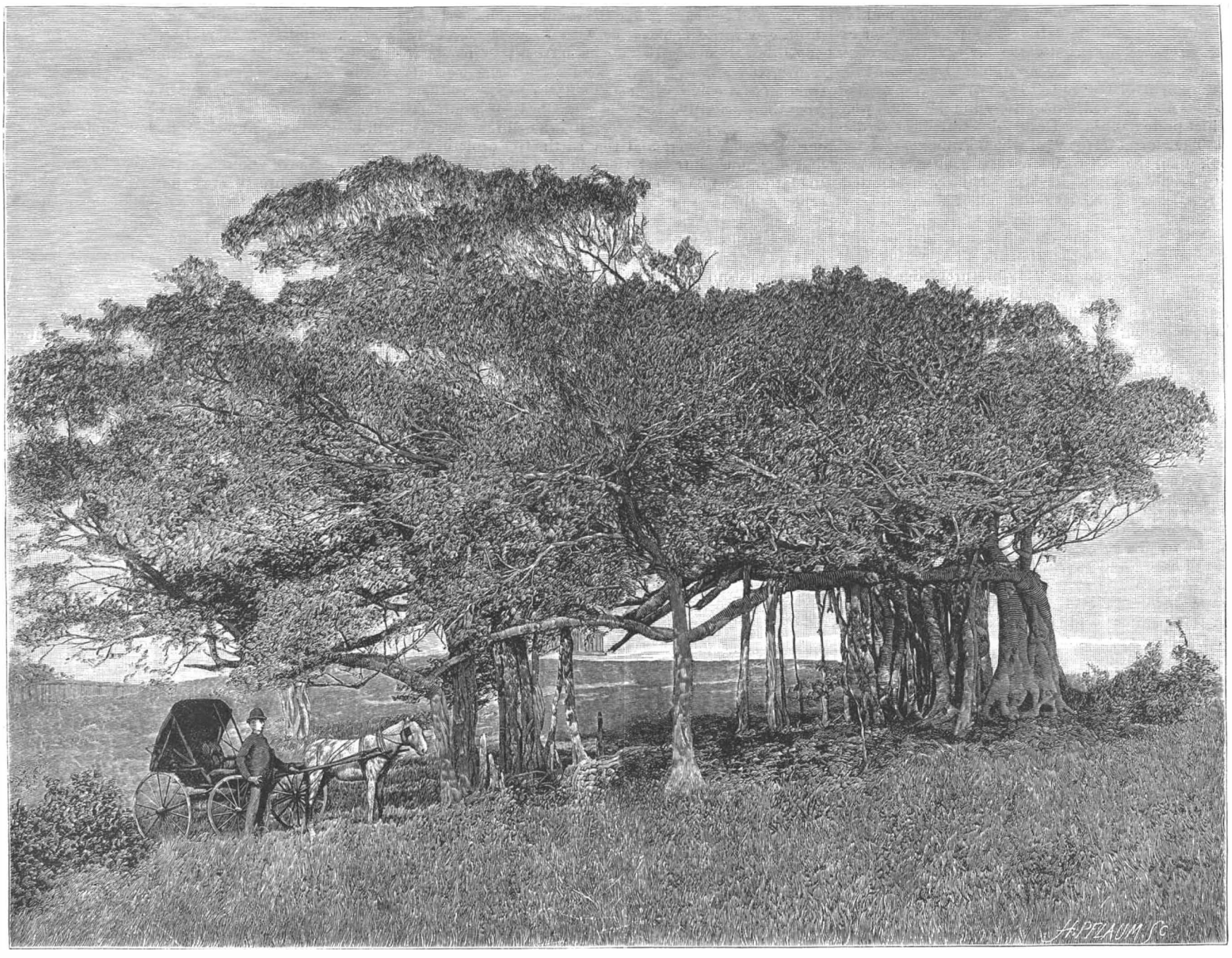
There are 1,250 16 c. p. 110 volt lamps. The maximum variation in potential will not exceed 1½ volts. Each lamp has its own switch, so as to be individually controllable. In the dining saloon the lamps are arranged in groups of ten, and connected with a main switchboard by which they can be turned off ten at a time as desired. The very elaborate electroliers and fixtures were supplied by the New York works of the Edison General Electric Co.

THE BANYAN TREE.

The Banyan tree (*Ficus religiosa* or *Indica*, Linn., *Urostigma Benghalense*, Gaspar.) is familiar to all from the pictures given in the geographies. In the school books it is shown spreading its branches far and wide, and sending down vertical depending rootlets, that, on reaching the ground, take firm hold and develop into large supporting trunks. There seems to be hardly any limit to the size it may attain. In Hindostan, where it reaches the greatest perfection, a famous tree stood on the banks of the Nerbudda. It was said that formerly 7,000 men could find shelter beneath its shade. It is supposed to be the tree which is described by Nearchus, the admiral of Alexander the Great. While greatly diminished in size by floods, what is left of it is 2,000 feet in circumference, and has over 3,000 trunks. (Forbes' "Oriental Memories.") Others are cited which cover over thirteen acres of ground.

It bears an abundant crop of small figs, not much larger in size than peas, insipid in taste, and possessing medical powers of rather low degree. The leaves, dark green in color, are so thick and cast so dark a shade that they prevent the growth of underbrush, thus, to an extent, favoring the attachment of the aerial roots. The fruit is devoured by the birds, who deposit the minute seeds far and wide on the ground and in crevices of stones or on trees. The seeds germinate, and the roots creep downward until the ground is reached. The tree then begins to take shape, and as it grows it sends down other roots from its branches. These develop until some of the new trunks are as large or larger than the original. In Hindostan, the vicinity of temples or suttee mounds, where Hindoo widows were formerly burned, are favorite localities for them, as the birds, the principal agents in their dissemination, were formerly attracted to these places.

The specimen here illustrated is probably the best developed specimen of this curious tree on this side of the Atlantic. It is about two miles east of Nassau, N. P., on the road along the shore, one of the most picturesque drives out of the city. If it had been properly protected and trained, and the shoots left to drop to the ground and take root, instead of being cut off and carried away by visitors, and eaten off by sheep and cattle, there is no doubt it would have been a much larger and finer-looking tree than it now appears. It is to be hoped that such a finely developed specimen of so rare a tree will in the near future receive the attention it requires, and be assisted in its onward march in trying to spread itself. It is worth one or more visits, and is a decided curiosity to those who have never seen a forest of one tree. Our engraving is from a photograph by Mr. J. F. Coonley, of Nassau.



AN AMERICAN BANYAN TREE.—(From a photograph.)

History of Electric Lighting.

Electric lighting, says M. Fontaine, did not make its appearance until near the close of the year 1873. It was in Paris, in November, 1873, in the workshop of M. Gramme, that the first installation on a really industrial scale of electric lighting took place, by means of a continuous current dynamo and Serrin regulators. It was also in Paris, in 1877, that the Jablochkoff candle was first employed; sixteen lights, distributed over a distance of about 1,100 yards, being supplied by a single alternate current Gramme machine. Paris, therefore, had the honor of possessing the first public and private lighting produced by means of electric currents. M. Fontaine thinks that in 1891 or 1892 the electric lighting in Paris will require for its production motive force equal, in round numbers, to 32,000 horse power.

ANY mechanic who feels like despairing, because the world has not gone well with him, should try, first of all, to figure out to what extent the world is to blame for his failure, and to what extent he himself is to blame. If he has not fitted himself for success, it is his own fault that success has not come to him.

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The End of the World.

It would seem impossible that, in our epoch of civilization and progress, there could still be found people to announce the approaching end of the world, and, what is much more extraordinary, that there could be found other people to give credence to them. Such is the case, however. A few charlatans, who perhaps descend from the middle age astrologers, whose ridiculous methods of divination they doubtless employ, have recently predicted that the world is shortly to come to an end, the date being fixed by some at 1898, and by others at 1901. These grotesque predictions, born of ignorance, have suggested to us the idea of succinctly presenting to our readers the rational causes that, according to the present state of scientific knowledge, might lead, not to the end of the entire universe, but only to that of our world—that is to say, to the disappearance of life from the terrestrial globe. We hope thus to reassure those, if there be any such, whom the predictions of sorcerers or jesters may have somewhat frightened.

At the present day, the public shows itself very incredulous upon this subject, but it was not always thus. In the past ages, when the absurdest superstition reigned, the astrologers found no difficulty in making people believe their idle tales. The year 1000, for example, is especially memorable for the great terror that extended over France and entire Europe, at the announcement of the end of the world. The advent of comets and the eclipses of the sun and moon were the chief pretexts for the frightful astrological predictions. The mortal terror with which France was seized in 1564, upon the news that a total eclipse of the sun was to occur, has remained particularly celebrated. The people, believing that the end of the world was at hand, ran to the churches in crowds to confess. A certain chronicler of the time tells us that a country curate, not being able to fulfill his task, was obliged to say to his parishioners: "My brethren, don't be in such haste; the eclipse is postponed for a fortnight!" In reality, there is nothing very alarming in the prospect of the ending of the world. That happens to every man on the day of his death, and the supreme event would not be any more terrible if it happened to all on the same day.

Terrestrial life depends entirely upon the light and heat of the sun, which is the sole source of its maintenance. It is therefore with the star of day that we have to begin the strange tableau of the probable causes of the end of the world.

THE SUN, ITS SPOTS AND ITS FINAL EXTINCTION.

The surface of the sun is often strewed with black spots, the smallest of which are as large as the diameter of the earth, and the largest of which are sometimes visible to the naked eye. These spots, which are variable in number and position, mark regions in which the luminous and calorific activity of the sun is in a state of temporary diminution. As the great radiant star is an incandescent mass (1,372,000 times more bulky than the earth) that unremittingly distributes its elements of life around it, it is continually losing (though slowly, it is true) the powerful energy that is stored up in it. A day will come in the distant ages when the spots that are already darkening the sun will cover its entire surface. A solid crust will afterward form, as one has formed upon the earth, which also traversed these phases of the life of a star, for our earth was a sun that had the moon for a planet, and perhaps even (according to Mr. Stanislas Mennier) a second satellite that is now broken up. The sun will therefore be extinguished some day for want of fuel, but that fatal date will be far in the distant future, for we can estimate the time necessary for the extinction of the sun at more than twenty million of years, and the time during which a state of life analogous to the present one will be able to exist upon the earth may be estimated at half that long period.

Long before the end of these far distant epochs, the progressive decrease of the solar heat will cause the glacial zones of the poles to extend toward the equator. Man, remaining almost alone upon the debris of terrestrial life, after having reached a transcendent civilization, will employ all the resources of his vast genius to fight a supreme battle with death. Perhaps he will then descend, one by one, the steps of his physical and intellectual development, and lead the miserable life of the Laplander and Esquimo under the equator. Then, the last human family, exhausted by cold and hunger, will sleep its eternal sleep upon the frozen and depopulated earth.

Although the existence of animate beings is still far from being endangered upon our planet through the extinction of the sun, the terrestrial world is none the less exposed to

CATASTROPHES OF OTHER KINDS.

When a brilliant comet appears and grows in magnitude in the depths of the heavens, popular superstition beholds in it an omen of dire misfortune, without knowing the only danger that the haired star threatens us with—that of a collision.

We may find examples of this superstition in ancient as well as in modern times. Here is what we may read in Pliny, and which relates to the comet of the year 48: "In the war between Cæsar and Pompey, we saw an example of the terrible effects that the advent of comets carries in its train. Toward the beginning of this war, the darkest nights were illumined, according to Lucan, by unknown stars, the heavens seemed to be on fire, glowing firebrands traversed the depth of space in all directions, and the comet, that appalling star, which overthrows the powers of the earth, exhibited its terrible coma."

These superstitious terrors inspired by comets have exerted their influence in our own age. The famous Encke's comet, that appeared in January, 1819, was the cause of lively apprehension in France, where sinister prophecies had been disseminated. At Paris, the previsions of the end of the world were taken more pleasantly, and songs and caricatures were made concerning it.

Among the millions of comets that are submitted to the attraction of the sun there are relatively few that approach the radiant star as far as to the orbit of our globe. The majority of the immense comets that occasionally traverse the heavens should therefore leave timid people indifferent. Those which, in their trip around the sun, pierce the plane of the terrestrial orbit, can alone menace us with some danger. We know that these celestial bodies have a very irregular course, and a most erratic conduct, for the least attraction of a neighboring star suffices to swerve them from their primitive route and make them approach the disturbing mass. In order that a collision may occur between a comet and the earth, the orbit of the first star must intersect the orbit of the second, and the latter must be at the point of contact of the two orbits at the time of the passage of the comet. It will be understood that such a combination of circumstances, although possible, has few chances of occurring. In fact, when a comet appears that is to approach the sun as near as we do, a calculation of the probabilities demonstrates that out of 280,000,000 chances, there is but one that it will collide with the earth!

We can consequently remain very tranquil on this subject. Yet, since we are assured that such a collision is among the number of facts possible, let us see what might be the consequences of this celestial meeting of the earth (traveling 18 miles per second) and a comet that had at least an equal velocity. If the comet had a consistent nucleus, the terrestrial crust would be staved in by the impact, and the torrents of lava that it conceals would produce a terrible commotion in contact with the waters of the ocean. In addition, the axis of the earth would be abruptly displaced. This is the sole plausible hypothesis to explain the inclinations of the axis of planets upon their orbit; but it is only right to say that no comet with a consistent nucleus has as yet been observed.

Were the comet formed of dense gases, it would cause an enormous pressure upon our atmosphere, and would bring on a hurricane a hundred times more terrific than the great cyclones, and would level the surface of the earth. It might also render the air unsuited for maintaining life by altering its chemical composition through the introduction of a new gas, or kindle an immense fire, such as the temporary stars sometimes offer us the spectacle of.

It is difficult to imagine the frightful consequences of such cataclysms for the animate beings who would be liable to perish amid this chaos of unchained elements. Shooting stars, those strange meteors that shine for scarcely a second in tracing a line of fire upon the celestial vault, are now considered by numerous astronomers as having a cometary origin, they being, so to speak, the debris of the haired stars. There exists a convincing example of this that will prove to us the possibility of a collision between the earth and the erratic bodies under consideration.

In 1832, Biela's comet, which accomplishes its revolution around the sun in the short period of six years and a half, intersected our orbit on the 29th of October, at the point that the earth reached on the 30th of November, say a month later. At the time of its appearance in 1846, the comet had divided into two, and in 1852 the twin comets were observed traveling together. Since this last passage, astronomers have not seen Biela's comet, but on the 27th of November, 1872, at the epoch that it crossed the terrestrial orbit, we traversed a mass of cosmic dust, which, on penetrating our atmosphere, gave rise to a true shower of shooting stars. On the 27th of November, 1885, we beheld a new conflagration of the heavens. Here, then, we have a demonstrated collision between the earth and the debris of a comet—a collision that will be repeated under the same conditions in 1898, a fact that has furnished an improvised scientist an occasion to announce the end of the world at that date. Let us hope that fate will protect our globe for numerous ages by preventing it from running against a good, healthy comet, and let us see what are the

OTHER DANGERS THAT THREATEN TERRESTRIAL LIFE.

Before reaching the present period of its history, the earth passed in succession through great geological phases, during which its continents and seas were several times deranged by the internal forces that its nucleus of matter in fusion developed. None of these revolutions has been able to destroy the powerful germs of life, and it is to-day more impossible than ever for a geological cataclysm to cause such a result.

The most important of the historic catastrophes of this kind is contemporaneous. We refer to the gigantic eruption of Krakatoa, in 1883, which claimed 50,000 victims, and totally transformed the configuration of the strait of Sunda. Despite their great violence, such phenomena are always local, and consequently without untoward influence upon animate beings collectively. The internal activity of our planet is now greatly reduced. So the earth has entered upon the calm period of its existence. A rapid examination of this progressive diminution of internal energy is to lead us to a particularly rational solution of the problem of the world's end.

When the solid crust of our globe formed, it surrounded an incandescent fluid spheroid, which afterward condensed toward its center under the action of cooling. In measure as it contracted this nucleus diminished in volume, and the external covering gave way in places, and cracked in order to follow the motion of shrinkage. It is in this way that were produced the large folds that formed the principal reliefs of the surface. Consequently, the terrestrial crust, having become thicker, will be covered with enormous crevasses through which the oceans and atmosphere will be gradually absorbed in the numerous internal spaces.

The surface of the moon, deprived of air and water, with the immense furrows that traverse its plains and mountains, presents the spectacle of this beginning of rupture, for our satellite is more advanced in development than the terrestrial globe.

Having passed this stage, the dead star, cracked in all directions, will break in pieces, and the fragments will be scattered along its orbit.

This destiny of the earth is still a thing of a very remote future. Yet it seems as if the natural evolution of our globe will cause the disappearance of life long before the extinction of the sun. It is, moreover, easy to see that in the geological epochs lost in the night of ages the vital forces were more powerful than those of our day. We have a proof of this in the exuberance of life that then gave birth to animals and plant beside which the present gigantic beings are but dwarfs.

The day on which, through such general weakening of vitality, man will have fallen into a physical decadence that his refined intelligence will not be able to supply the place of, will probably be also the day on which the last representatives of our race and of the entire creation will have to live in the bowels of the earth in the pursuit of air and water, which will slowly descend toward the center of the earth.

Deprived of atmospheric fluid, the surface of the globe will thereafter have for temperature only that of interstellary space, say a hundred Centigrade degrees below zero! And while our human race will be reimmersed in the nihility from which it had emerged for a few thousands of centuries, other humanities will succeed one another upon the innumerable stars that people infinite space.—*Jacques Leotard, in La Nature.*

Climbing Snakes.

My farmer friend, Hiram Carpenter, who lives three miles out of town, invited me to call at his place and see where he found a snake four feet and three inches in length and one and a half inches in diameter. The swallows nest under the eaves of his barn, which project some twenty inches from the building. The rafters do not run out more than one-half or two-thirds of this distance, the space between them being quite thickly studded with the mud nests of the swallows. One pleasant day in June his son noticed quite a commotion among the birds, and called him to the spot. They were amazed to see a large snake clinging to the end of a rafter, with its head in one of the nests, evidently devouring the young birds. The reptile was able to cling to the end of the rafter by hugging it tightly, and was only dislodged after some effort. It had swallowed two young birds, and another was part way down its throat. The young man had not "believed in killing snakes," but on this occasion he dispatched the reptile forthwith. The barn is sheeted up with rough pine boards, upon which there are two coats of paint, and from the ground to the point whence the snake was dislodged the distance is nineteen feet and four inches. How it managed to get to the spot seems altogether a mystery. There was no hole through the side of the barn nor under the roof boards, nor did it seem possible for it to have worked its way from the top of the roof. Then, it was quite as difficult for it to have found a way to the roof. Mr. Carpenter is a most reliable observer of all natural phenomena—an investigator, really—but he was unable to form any opinion as to how the reptile reached its prey. He described it as resembling the common garter snake, except in the matter of its great size, hence I could form no idea as to the species to which it belonged.—*Charles Aldrich, Webster City, Iowa.—American Naturalist.*

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Our Great Debt to Science.

There are many thousands of short-sighted people that raise a utilitarian cry against the investigators in pure science. Yet these people use the telephone, the telegraph, the electric light, ride on electric cars, and sigh for further applications of electricity to the needs and uses of everyday life. But they never think of Galvani and his frogs' legs. Take out of the world all that science—studied for the pure love of it—has done, and the habitable globe would be in just the state of uncivilization that Central Africa is to-day. Science does not create labor, nor the industries flowing from it. On the one hand, science is the progeny of the industrial arts; on the other, of the experiences and perceptions that gradually attach themselves to these arts. Industrial labor is one of the parents, and science is the child; but, as we often see in the commercial world, the son becomes richer than the father, and raises his position. Man is the ward of science, and from his necessities spring the industrial arts; the mole can mine and tunnel under the ground; the tailor bird can sew; the fishing frog can throw out a line and bait that nature gives him; the beaver can plaster his house; the spider can spin and weave; but neither in his hands nor feet has man the tools for such work as he must perform in order to live. How have the arts received their great impulses from science? In the early ages the raw material at hand led to its industrial application; and later on the country possessing the raw material became impressed with the character of its industries. The mound builders of America became coppersmiths, because they found native copper, which they considered a variety of stone, and chipped and hammered it into tools without knowing how to forge it hot. Savages living out of the region of native minerals became workers in stone, flint, horn, bone, or shell.

As civilization advanced and commerce became established, the mere possession of raw materials was not the only condition of industry. Possessed of what they considered good weapons, barbarous nations broke through the barriers that shut them from the outside world. While the Thracians were scalping their enemies, and spending much time in tattooing their bodies, their neighbors the Phenicians, sailing the Mediterranean as the Tyrians had done before them, found their way out into the Atlantic, and thence to the British Isles. The natives of these isles, dressed in skins, and with their bodies daubed over with yellow ocher or woad, were living and fighting over mines of tin and other minerals that they knew not of. The Phenicians found these mines, took back tin and other minerals with them, and established metallurgic industries. They were acting under the guidance of an infant science. As intelligence rose in the British Isles, and an initiatory science was developed from industrial pursuits, the people no longer sold their raw mineral material to distant nations, but manufactured it for themselves. So long as the growing intelligence of a nation equals or exceeds that of any neighboring nation, its prosperity is secure. The moment any nation allows the intellectual element of production to fall below that of its neighbors, a mere local advantage no longer insures superiority. Science and commerce having opened up paths of rapid intercommunication around the globe, the cost of carrying raw material is lessened; and, given an intellectually inferior nation with raw material, the intellectual superiority of another nation far outbalances the possession of that raw material. Intellect is the great factor in commercial success, whether of individuals or nations. Take the case of the skilled bricklayer and of the hod carrier; the first is using brains in his work, the second is using brute force. When he goes up the ladder with his hod of bricks, he has to carry also his own weight—thus wastefully expending force. Some one notices this, and substitutes for the brute force of the human that of the horse; then the horse is displaced by the mechanical force of a steam engine, which can do the work of fifteen men or of two horses in the same time. Coal converted into heat is doing all the work. The coal mined each year in the United States represents in actual work more than the sum of the force of the total population of the globe, assuming all to be strong men. Thus the substitution of a natural force for human power vastly increases the productive capacity of the human race. Guided by an intellect taught by science, the natural forces can do in a few hours what the unaided labor of many men could not do in a lifetime. It was not prophecy, but a flash of genius, that drew from Stephenson the assertion that it is the sun that drives the locomotive engine, by being liberated from the coal in which it has been stored for ages. But man can neither create forces nor endow anything with properties; all that he can do is to convert and combine them into utilities. The man that does this with knowledge is spared the dismal failures of ignorance, but he that tries to use powers without understanding them is inevitably punished for his rash presumption. It is this presumption that causes the mortality and disease that follow in the wake of civilization. Natural law, like the civil, never admits ignorance as an excuse.

In this century three scientists have revolutionized commerce—Oersted, of Copenhagen, and Faraday and Wheatstone, of London. It was of Faraday that Huxley said, in effect, that any nation would do well to spend $500,000 in discovering such a man, and an equal amount in educating and setting him to work. Bessemer, studying away at steel, has revolutionized ship building. Dr. Joule's studies in the mechanical equivalent of heat produced the compound engine, by which the necessary amount of coal for carrying a given cargo has been reduced more than forty times; that is, a steamship that in 1850 carried a cargo at an expenditure of 14,500 lb. of coal to a ton now does the same work by burning about 350 lb. Joule's studies in heat have made it possible for a cube of coal that will pass through a ring the size of a 25 cent piece to drive one ton of cargo for two miles in one of the most improved steamships. In 1880 the rate on grain from New York to Liverpool was 9¼d.; in 1886 it was 1d. a bushel. The reduction was primarily due to the scientist Joule. Every time we strike a match we are indebted to the men that have studied science for the mere love of it. The men that worked away at coal tar "just to see what was in it" made the whole world their debtors by discovering alizarin, the coloring principle of madder. And to these men the world is indebted also for aniline, antipyrine, and more than a hundred other coal tar products. Scientists, wondering what was in crude petroleum, found paraffin and vaseline. Pasteur wondered what caused fermentation; he found out, and brought a new era to wine making. The singing and dancing of a tea kettle attracted the attention of a brain, and we have as a consequence all the applications of steam. The swinging of a chandelier in an Italian cathedral before the eyes of young Galileo was the beginning of a train of thought that resulted in the invention of the pendulum, and through it to the perfecting of the measurement of time; and thus its application and use in navigation, astronomic observations, and in a thousand ways we now pass by unnoted, has been of such practical and unceasing value that the debt to scientific thought, even in this one instance, can never be known. Science, in its study of abstract truth, is ever giving to man new beginnings. While the devil is engaged in finding mischief for idle hands to do, science is eternally at work finding something useful for them to do. Perhaps not eternally, but so long as there is an earth, so long as there is a human race, and so long as there remains unrevealed one secret of nature, there will be the scientist studying for the pure love of investigation, and discovering abstract truths that shall benefit humanity. If the world shall ever be at peace in a brotherhood of mankind, that peace will owe its existence to the student of nature—the scientist. Science is knowledge; art is skill in using it. A principle of science is a rule in art. Art may make mistakes by wrongly applying or by ignoring the truths of science. Railways, ocean steamships, all the uses of steam and electricity, gas, our huge buildings, our manufactories, and all that adds to our material comfort, are due to the practical application of scientific principles.—*Chicago Herald.*

A Precocious Musician.

A remarkable young musical wonder has just been brought to the notice of the music-loving public of Chicago. She is little Elsa Breidt, the five year old daughter of Julius Breidt, of 2510 Cottage Grove Avenue, a jeweler and watchmaker. Her mother says that when she was two years old, the child began to sing airs that any one might be playing at the piano. When the little girl grew larger, she used to climb up on the piano stool and strike the keys as if she had been taught how to do it a long time ago. She immediately learned to play chords, and before she was three years of age could carry parts of airs correctly. Half a year later she played accompaniments to the violin, and when she was little more than four years old she began to compose or improvise. Her mother says: "One day there was a terrible rain and thunder storm, and when it was over Elsa went to the piano and played the wildest sort of an air, that almost brought the storm and its music back to me. She will get up on the piano stool and begin singing softly some measure or strains that have come into her head, and after humming it over several times she plays it. That is the way she composes her pieces. If I play sentimental or lively music, it affects her strangely; in fact, we cannot play pathetic airs, as the tears come to her eyes, and she is much agitated. She enjoys herself much as other children do, but if she hears the sound of music she will stand listening with mouth, eyes and ears wide open. Any ordinary composition she can play almost absolutely correct after having heard it once."

The father and mother of the little girl have been unwilling to have her obtain notoriety, but some music teachers who know of the little one's genius have told others about her. Lily Lehmann, D'Albert, and most of the local musical world have heard the child play. D'Albert wants her to go to his home in Germany and receive a thorough musical education. When he was here, Elsa played for him. The great musician declared that her genius was wonderful. The other day she played for a party of critics. First she gave a selection from Schumann. The execution was pronounced marvelous, and after the child had finished with an improvised little melody of her own, the musicians went into an ecstasy of praise. One of the best things she did was to play an "Ave Maria." Although it had been weeks since she had touched the Bach-Gounod composition, she gave it without missing a note or sounding a false one.—*N. Y. Sun.*

The Decay of the Mechanic.

The good machinist is in demand, and the situation seems to indicate a majority of vacancies and a minority of men. The particular type of skilled article that is wanted is hard to find, and the difficulty increases rather than diminishes. One of the causes lies in our modern methods of industrial education. The subdivision of labor, for the purposes of increased production and a cheapening process, has sectionalized our skilled industries; each man has his place in the alignment, and becomes just what the manufacturer wants to make him—a specialist in a certain department. His skill is consequently limited, and his knowledge of a trade confined to the hole in which he acts as a stationary peg. The effect of this, in a general sense, degenerates the tone of industrial ambition, and the man that can command good wages with but one qualification is not likely to double the original stock. In our present system of industrial economics the specialist may be indispensable, but the all-round and thoroughly instructed artisan will always be in demand, and the perpetuation of this rare article be an industrial policy. This can be best secured by an improvement in the system of apprenticeship and less of the shop legislation that in some cases interferes with the rights both of the employer and the apprentice. The attempt to run a young hand in the old rut of skill and product is not wise. A trade is best protected by the excellence of its work, and that mechanic is the most independent who is the best master of his business. A botch workman is an incubus on master and man, and his protection by the union to which he may belong has involved the trades in bitter strikes and much loss.

Our industrial development has made such rapid strides and assumed such enormous proportions that it has necessarily incorporated many incompetent and untrained workmen, who under other circumstances would not have found their way into the higher departments of skilled industries. The consequences are apparent, and the complaint of inefficiency is general. We note some wise and weighty words on this subject in an address delivered by President Penton at the convention of the Brotherhood of Machinery Molders, held in Indianapolis, August last. He says: "It is to be hoped that this convention will see its way clear to take some action toward the establishment of a more regular and uniform apprentice system. Employers in all directions are complaining of the difficulty of obtaining competent mechanics, a trouble arising mainly through the entire lack of any system of educating or teaching apprentices. Large numbers of the so-called molders in the country have picked up a few ideas here and there, and after a brief experience, perhaps in a stove or bench shop, undertake 'to travel,' filling the places, in some instances, of more competent workmen, thus injuring the standing of the trade, and preventing its being learned by those who would develop into good workmen under proper training. An effort should be made to secure the co-operation of employers in the adoption and enforcement of some general system."

This advice is sound and the counsel wise, and its industrial indorsement is the only practical escape from a threatened evil. The younger and coming type of mechanic must not be less than his predecessor in skill, or the pre-eminence of America in mechanics will be a thing of the past, and the art that commanded good wages will be so fractionalized and limited that the less of skill the less of pay, etc.—*Age of Steel.*

Botanical Notes.

Influence of Altitude on the Development of Plants, M. Gaston Bonnier.—The author has observed that the amount of carbon dioxide decomposed by plants increases with the altitude. Plants cultivated in an Alpine climate undergo a modification of their functions such that the chlorophyllian assimilation and transpiration are augmented, while respiration and transpiration in the dark appear little modified or slightly diminshed.

Chlorophyllian Assimilation, M. Henri Jumelle.—The author has investigated the difference of physiological functions in the leaves of the green and red type of such trees as the beech, sycamore, elm, etc. He finds: 1. In trees with red or coppery-colored leaves the chlorophyllian assimilation is always more feeble than in trees of the same kind having green leaves. 2. The intensity in the copper beech and purple sycamore is only about one-sixth that of the ordinary types of the same trees.

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RECENTLY PATENTED INVENTIONS.

Mechanical.

HOISTING DEVICE. — Mr. William P. Campbell, of Rome, Ala., has patented a hoisting machine in which a weighted sweep pole is used. In this machine the multiplying power of a rope and pulleys is employed to give the bucket a greatly multiplied motion. This improvement is designed for raising water from wells, hoisting brick and other materials for building purposes, and for analogous uses.

WICK TRIMMER. — A practical device for trimming circular lamp wicks has been patented by Mr. William R. Cole, of Pottsville, Pa. In this machine a frame or stock is provided with a lateral trimming knife, the stock being arranged to be rotated on or within the burner so as to carry the knife in uniform contact with the charred end of the wick. By means of this instrument a circular wick may be uniformly trimmed.

CIRCULAR SAW. — Mr. William A. Miller, of Wapinitia, Oregon, has patented a saw which will cut freely in different qualities of wood, when used either as a cross-cut or rip saw. This improved saw has a series of radial tooth sections, each composed of a thick leading main tooth and an integral thinner auxiliary tooth, the auxiliary teeth being formed by notching the peripheral edges of the tooth sections.

SPLIT PULLEY. — An inexpensive and efficient power-transmitting pulley, which may be easily applied to or removed from the driving shaft, has been patented by Mr. Henry C. Lewis, of Saginaw, Mich. This pulley is made of wood, and furnished with a fastening which prevents it from turning on the shaft under heavy strains, and will cause it to remain true on the shaft.

ATTACHMENT FOR PRINTING PRESSES. —An improved attachment for cylinder printing presses, designed for printing additional colors at one operation in the reading matter or advertising columns of newspapers, or on job work, has been patented by Mr. William E. Freer, of Norwalk, Ohio. This improvement consists of an auxiliary type cylinder arranged to be turned in unison with the other parts of the printing press, and carrying type charged with ink of the required color, the type being arranged so as to print in the blank spaces left in the printing regularly done by the press.

TRANSOM LIFTER.—Mr. Emil Herz, of New York City, has patented a device for opening, closing, and locking doors and pivoted or hinged windows. In this device a vertically arranged shaft on the door or window casing is provided at its lower end with a handle by which it may be turned, and at its upper end with a lever connected by a link with another lever on the door or transom, these levers being relatively arranged so that the movement of the door or transom corresponds to the movement of the shaft. In the support of the upper end of the shaft are formed notches, and the upper lever is provided with a lug adapted to enter either of these notches and lock the lever, and consequently the window or transom in any desired position. The device is unlocked by lifting the shaft.

Engineering.

RAILWAY GATE.—A railway gate of the class used on the elevated railways has been patented by Mr. John B. Carey, of Brooklyn, N. Y. This gate effectually prevents passengers from being crowded from the platform. It also prevents passengers from being pushed into contact with a moving train. The invention consists of a continuous barrier extending the whole length of the platform, and suspended from levers, the levers being so arranged that the entire barrier may be raised or lowered at one operation.

Electrical.

UNDERGROUND ELECTRIC CONDUIT.—This invention, which has been patented by Mr. Charles E. Loth, of Troy, N. Y., provides for laying the wires in such a way that insulating covering may be dispensed with. It also provides for the gathering and removal of water which might otherwise accumulate in the conduit. It is also furnished with means for protecting linemen from injurious shocks. The inventor has also devised means for ventilating the conduit so as to prevent the accumulation of gas.

COUPLING FOR ELECTRIC WIRES.—Mr. James J. Hinphey, of Boundbrook, N. J., has patented a coupling for electrical conductors such as are used on railway cars, for signaling from different parts of the train. This improved coupling is constructed so that in case of the separation of the cars, the circuit will be closed automatically as the electric couplings are detached, thus maintaining the circuit. This invention also provides means for signaling the engineer in case of the accidental separation of the couplings.

RHEOSTAT.—Dr. J. H. Gunning, of New York City, has patented a rheostat for controlling primary or secondary currents and for introducing resistance into the electric circuit wherever it is required. This invention consists in the combination with a tapering resistance piece formed of a conductor or semi-conductor of a roller adapted to roll upon the tapering piece, from the narrower to the wider end of the resistance piece, or in the reverse direction. The device is provided with means for graduating the pressure of the roller upon the resistance piece. This invention is designed more particularly for use in connection with medical batteries, but it may be employed in connection with electro-plating machines and in electric lighting.

Miscellaneous.

CIGAR CUTTER. — Wilhelm Scholer, Eiland, Solinger, Germany. This is a device of the class known as "piercers," and is designed to tip the cigar without tearing or disturbing the wrapper, the cutter being of suitable size to cut a small hole in the tip of a cigar to give free draught, while the device may be conveniently carried on a chain or in the pocket.

BOX SCREW AND CLAMP. — Phillip N. Bailey, Winston, N. C. This is a device particularly adapted for use in packing tobacco in boxes and lining the top of the box while held down upon the tobacco the device being simple and durable and dispensing with the cumbersome and expensive ones now in use.

TRUSS.—Alonzo D. Smith, New Woodstock, N. Y. Combined with a curved spring is an adjustable spring-pressed pad, to produce an inward and upward pressure, while there is a curved slide for adjusting the pressure of the spring, another pad being added to adapt the truss to a double hernia.

URINAL. — Joshua R. Gibson, Cincinnati, Ohio. This invention consists of a combined spreading and spraying nozzle arranged adjacent to the rear slab of the stall, and at an angle thereto, whereby the water is spread in a thin sheet upon the slab and all splashing is avoided.

SASH FASTENER. — Mr. Francis E. Drake, of Columbus, O., has recently patented a device for fastening together the ends of two parts of an overlapping sash or belt. This device consists of a stud furnished with suitable fastening plates attached to one end of the belt or scarf, and a socket secured to the opposite end, the socket being provided with a spring catch for engaging or holding the stud.

WHIP.—Mr. J. W. Middleton, of Kingston, Jamaica, West Indies, has patented a whip having a hollow tapering stock provided with a removable cover at its butt end, a thong fitting loosely in the small end of the stock, and a wedge in the butt of the thong, to prevent its removal from the stock.

PAPER FILE.—Mr. John M. Willis, of New York City, has patented a paper file which may be expanded more or less so as to inclose a large or small bundle of papers. This file is provided with a rigid front and back section, consisting of a plate or board having a transverse opening therein extending through from side to side. To the back board are attached bands or aprons, one of which is permanently attached to the front board, while the other is provided with an end strip, which is inserted in the slot of the front board when the file is closed.

METHOD OF TREATING COTTON SEED HULLS.—Mr. Emil Bohn, of Galveston, Texas, has recently patented a process of producing paper stock from cotton seed hulls. The object of this invention is to utilize a product that has heretofore been wasted. By means of suitable machinery, the hulls are reduced to fine particles, which are capable of "felting." The material thus produced forms a superior article of paper stock.

KNIFE.—Mr. Wm. P. Bailey, of Stowe, Vt., has patented an improved guard, which is particularly adapted for use upon knives of various kinds, but which may be also applied to fishing rods, hammer handles, and other tools. The guard is furnished with a thumb rest and ring, which enable the user of the implement to which it is applied to obtain a firm hold of the handle.

SCIENTIFIC AMERICAN
BUILDING EDITION.

SEPTEMBER NUMBER.—(No. 59.)

TABLE OF CONTENTS.

1. Elegant plate in colors of a residence at Holyoke, Mass., erected at a cost of $7,000. Perspective view, floor plans, sheet of details, etc.
2. Plate in colors representing a residence at Mechanicville, N. Y., erected at a cost of $2,500. Floor plans, perspective elevation, sheet of details, etc.
3. View of the interior of an artist's studio.
4. Architectural sketches in Bradford, England. The technical school and the town hall.
5. A residence at Short Hills, N. J., erected at a cost of $9,000 complete. Perspective and floor plans. Wilbur S. Knowles, architect, New York.
6. A cottage at Short Hills, N. J., erected at a cost of $7,000. Floor plans and perspective view.
7. Cottage at Springfield, Mass. Cost $3,200. Perspective view and floor plans.
8. Engravings and floor plans of the residence of W. G. Russell, Esq., at Short Hills, N. J. Cost complete $25,000. Lamb & Rich, New York, architects.
9. Engravings and floor plans representing some very handsome houses erected on West 86th Street, New York city. Cost about $36,000. Mr. J. Prague, of New York, architect.
10. View of St. John's church, to be erected at San Francisco. Estimated cost about $57,000.
11. A village church erected at Short Hills, N. J. Lamb & Rich, architects, New York.
12. Perspective and floor plans of a dwelling at Holyoke, Mass., erected at a cost of $12,000 complete.
13. Miscellaneous contents: A new decorative material.—Independent homes.—Good planning.—Different clays.—Building liens.—An improved ventilator, illustrated.—Improved bath tubs and bathing appliances, illustrated. — Richmond heaters for steam and hot water, illustrated.—A mitering and jointing machine, illustrated.—Power's regulator for steam and hot water heaters, etc., illustrated.—Paper for working drawings.—Geometrical wood carvings, illustrated.—Steam and hot water heating, and for power, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2440) H. W. S. asks: Will you kindly inform me how I can obtain the skeletons of small animals, such as mice, rats, etc.? I wish to make a collection of some. A. Place the carcass near some ant hills. The ants will in time strip the skeleton.

(2441) E. S. wishes to know how to refine photographic wastes and obtain the amount of nitrate of silver they contain. Also give me a process for making nitrate of silver and of pure silver metal, and the same for chloride of gold in a dry state, the same as put up in 15 grs. bottles. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 377, page 6013, as to recovering residues. To make nitrate of silver out of pure silver, place the silver in a beaker and pour into it three quarters of a fluid ounce of strong nitric acid sp. gr. 1·4 for every ounce of metal. The beaker is heated till the whole of the silver dissolves, the solution is then poured into an evaporating basin, and the excess of acid driven off by boiling. The operations should be conducted in the open air. The salts left may be recrystallized by dissolving in the smallest possible quantity of boiling water, and allowing it to cool. The crystals of pure nitrate of silver will gradually form. The salt remaining in the mother liquor can be recovered by evaporation. To prepare chloride of gold the copper in the coin must first be eliminated. The gold coin is put into a beaker, and a mixture of three parts of hydrochloric acid and one of nitric acid is poured into it and heat applied until the metal is dissolved. The excess of acid is then expelled by evaporation. The impure gold chloride, when free from acid, is dissolved in boiling water, and a cold saturated solution of protosulphate of iron added, till a dark precipitate of pure gold is no longer produced. The precipitate of gold must be poured on a filter, and washed by pouring boiling water constantly over it, till the wash water no longer produces a precipitate with a solution of barium chloride, proving that the gold is free from the excess of sulphate of iron. The gold is again dissolved in nitro-hydrochloric acid, the solution evaporated to dryness, the latter part of the operation being carried on slowly to prevent spurting. The yellow crystalline chloride of gold thus prepared should be preserved in a well stoppered bottle or a sealed tube, as the salt is very deliquescent.

(2442) H. B. asks for blue print paper that will keep well. A. The following:

Chem. pure ferricyanide potassium.....256 grs.
Water..... ..... 4 ozs.

Keep bottle covered with black paper and well corked; 1 drachm equals 8 grains. This solution will keep indefinitely. No. 2, which should be mixed fresh each time:

Citrate of iron and ammonia.....50 grs.
Water..... ½ oz.

Mix equal parts of above different solutions before coating the paper, and add also to each ounce of solution 1 grain of bromide of potassium. The bromide tends to make the paper work slower, but keeps it fresh.

(2443) G. B. D. asks how to color sand blue and black for painters' use. A. We presume you refer to blue and black smalt. These are composed of pulverized glass of the desired color.

(2444) O. J. H. asks: 1. In case of an electrical storm is it best to close up the house tight, or else leave it wide open, and why? A. It is best to close the house, as the warm air currents from the open windows and doors form good paths for the lightning discharge. 2. If a person is above the clouds, can an electrical storm or any other do him harm? A. If above the clouds and still upon the earth, there would be danger. 3. How can I harden paper so as to make it as hard as wood or canvas? A. It is generally hardened by treatment with dilute sulphuric acid. It is also hardened by compression and by treatment with size. 4. Which propels a vessel the fastest, a screw or paddle wheels, and are there any other kinds of propellers? A. In the matter of speed there is not much difference. There are many other propellers, among which are the turbine, the water jet, reciprocating paddles, etc. 5. What is air composed of? A. Oxygen 20·96, nitrogen 79, carbonic acid 0·04.

(2445) F. W. L. asks (1) how to make a photograph on a ten cent silver piece. I tried it in different ways, but without success. A. Make a reduced negative from the picture to be imprinted. From the negative print a positive by development on Eastman's transferotype paper. Coat the coin with weak solution of gelatine and transfer the picture from the paper to the coin as per directions accompanying paper. 2. Where are the five currents taken from in an electro-medical coil? A. One current is taken from the primary, another from the secondary; the others are obtained by fractioning or combining these.

(2446) A. T. F. asks: 1. Is fuel gas (for fuel purposes only) actually manufactured upon a large scale? And if so, at what price is it supplied to consumers? A. It is not manufactured to any extent except for particular metallurgical or other works. If the supply of natural gas diminishes, then it may become a most important manufacture. 2. What is the equivalent (say in pounds of good anthracite coal) of 1,000 feet of water gas, not enriched with carbon? A. It consists of equal volumes of carbonic oxide and hydrogen. One thousand cubic feet contain 36 97 pounds carbonic oxide and 2·64 pounds hydrogen, equal in heating power to 22·42 pounds pure carbon, or to about nine-tenths of this amount of anthracite coal. 3. Can gas made by passing superheated steam through incandescent coal or coke, and not enriched with carbon, be sent for long distances through pipes? Or will it condense in transit, or otherwise lose its value? A. Yes; but it will be apt to lose hydrogen, especially through leakage.

(2447) W. E. V. writes: I have a valuable old opera glass incased in an ivory shell. Same has turned quite yellow with age, and would ask you if there is not some way that I could change the color to black. A. Soak the ivory alone in dilute solution of nitrate of silver and expose to the sun under glass. Repeat until black. Absolutely none of the metal parts must be immersed or they will be ruined. You might try bleaching it by exposing to the sun in a vessel of spirits of turpentine.

(2448) W. B. writes: I would like to experiment with condensed magnesia on electric lighting. It has been used with the sun lamp, but I have so far been unable to procure it. A. The substance is simply magnesia which has been pressed by hydraulic pressure. You could have this done for experimental purposes in any machine shop possessing a powerful press. Even a machine punch used for boiler plates might do the work. The sun lamp has not come into general use as yet.

(2449) S. H. G. writes: I want to generate hydrogen gas in a cast iron retort that is of 1 gallon capacity, and convey it direct by iron tubing ⅜ inch, opening into a medium sized iron cylinder. Cannot get over 9 pounds pressure (by accurate gauge) in the cylinder. What is wrong? A. Your cylinder may be so large that the retort will not generate from one charge enough gas to develop more than the pressure stated. Possibly there is a leak. Your cast iron retort will not stand the action of acids very long, as, even if zinc is used, some corrosion is inevitable.

(2450) T. L. J. asks: 1. Is a current supposed to be induced in a coil in one direction by approaching and in reverse by receding from the pole of a magnet, or simply by cutting lines of force emanating from pole? A. By both. In general terms, any change in relation of coil to fixed pole, whether of position or of intensity, produces a current. It can almost always be represented by cutting lines of force. 2. In the formation of water from hydrogen and oxygen gas do the gases expand, or is the explosion caused by the sudden contraction of the gases? A. The expansion of the vapor of water produced in the combustion causes the explosion.

(2451) F. V. B. writes: Can you tell me how I can get silica of impalpable fineness with least trouble and expense? A. Buy silicate of soda solution

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from a dealer in chemicals, dilute with five parts of hot water, mix thoroughly, and add excess of sulphuric acid. Filter off the silica, which will be precipitated, and wash with hot water.

(2452) S. J. R. asks how to harden tallow in order that it may be used in lumps to rub on lumber and skids. Summary: We get tallow of a very inferior quality sometimes, which is soft and falls to pieces almost as if rotten. We wish to know how to cheaply restore it to the consistency of first-class tallow? A. Try melting it and mixing it with paraffine wax. This is the simplest method we can suggest, if not too expensive.

(2453) E. K. writes: I want to make a blackboard by covering heavy cardboard with some kind of slate preparation. Can you, through your paper, give me a good recipe for blackboard slating? A. Use a strong solution of shellac mixed with dry ivory black and ground pumice stone, and ultramarine blue. 1 gallon 95° alcohol, 1 pound shellac, 8 ounces black, 4 ounces blue, and 5 ounces ground pumice or fine emery is a good formula.

(2454) I. H. asks (1) for the formula for the preparation known as silicate for blackboards or a similar preparation. A. See preceding query. 2. Can you inform me as to what method I could adopt to prevent a safe lock being affected by the damp? Our lock becomes coated with verdigris, caused by dampness of safe door. A. We can only suggest having parts lacquered, or if they are exposed to friction in working, try vaseline as a lubricant. Even used as a coating it will keep off verdigris.

(2455) A. L. asks how to soften hard water without chemical. A. Some hard water is softened by boiling. If a sediment forms, decant the clear fluid.

(2456) F. W. S. asks at what degree Fah. the following metals fuse: Gold 1000 fine, aluminum, silver, and brass. A. Gold, 2016° Fah. Silver, 1873° Fah. Aluminum, uncertain, and varying greatly with purity of metal, 1290° to 1560° Fah. Brass varies so in composition that no melting point can be given. It will vary from 800° to 2000° Fah.

(2457) G. H. B. asks: 1. What chemical or other solutions are there that have fireproofing qualities? (For instance, to saturate cloth or paper.) A. Tungstate of soda and phosphate of soda are excellent, especially the first. Even common salt has some power. 2. What wash or paint, that adheres well when exposed to weather, has fireproof properties? A. For rough work a wash made of cement and water might be recommended. For a roof paint consult our advertising columns. 3. What ingredients added to common whitewash would greatly increase its adhering property? Iron oxide paint partly answers this, but I want a paint or stain for roof, preferably in green, that will hold, and I do not think the stains, now much used, are satisfactorily permanent, except in red. A friend showed me a number of barns built of rough hemlock boards. He made a thin glue sizing and gave them a wash of it, following immediately (when dry) with a coat of mineral (iron) paint. It gave the buildings a smooth finish, and paint lasted for years, and for that matter still lasts. I was surprised at its lasting quality and mentioned it to a house painter, he said it was a good and satisfactory way to treat such buildings. A. The government receipt for whitewash, already given in these columns, may be repeated: Slake ½ bushel of lime with boiling water, keeping it covered during the process, strain, and add 1 peck of salt dissolved in warm water, and 3 pounds rice flour boiled in water to a thin paste, ½ pound Spanish whiting, and 1 pound clear glue dissolved in warm water. Let it stand several days and apply hot. 4. Crude petroleum applied to wood has preservative qualities. Would green or other pigment added (for roof) give a permanent color? A. No pigment should be added to crude petroleum. 5. Could any ingredient be added to overcome the combustible nature of the petroleum? A. No.

(2458) G. M. C. asks: 1. Suppose dynamo and motor are seven miles apart. What per cent should the motor develop if 100 horse power is put into the dynamo? A. From 60 to 70 per cent. 2. What size of wire should be used to carry the current to the motor? A. It depends upon the current used. 3. Should the wire be insulated from the atmosphere? A. Preferably, but not necessarily. 4. Is it necessary that there be a return wire from the motor to the dynamo? Why not use the earth? A. A return wire is necessary on account of danger of grounding along the line through workmen or others. 5. About what is the resistance in ohms of motor described in SUPPLEMENT, No. 641? A. About 4 ohms. 6. About how many volts are necessary to run it successfully? A. An E. M. F. of 6 to 8 volts. 7. Would it make any difference if the field magnet of this motor was forged from soft iron? A. You can use either wrought or cast iron. 8. Why is it necessary that the resistance of the motor should be increased if a high resistance battery is used to drive it? A. The greatest amount of work can be realized when the resistance of the battery and external circuit are equal. 9. Should the battery cells be arranged in parallel or tandem? A. They should be connected in such a way as to secure the above E. M. F. and as large a current as necessary.

(2459) Jack asks: 1. The easiest and cheapest way to melt wrought or cast iron in small quantities, say up to 10 or 12 pounds, also lead. I have a small portable forge. A. Use a plumbago crucible, with a little borax as a flux. You will probably not succeed in melting such large quantities, and certainly not the wrought iron. 2. The cheapest way for me to take impressions or copies of letters that I write, and wish to keep a copy or duplicate of on file for reference? A. Use copying ink and a copying book and press. Simple hand copying appliances are sold by stationers to take the place of presses. 3. In splitting logs or other large timber for fence posts, wood, etc., can I not use powder or dynamite, instead of wedges and mauls? If powder, will common gunpowder do? A. Yes. Bore holes and use gunpowder, not dynamite. Tamp the powder with fine sand or brick dust. Bore inch holes and insert from two to four inches of powder. 4. Are there steamboats in use that use naphtha for making steam? If so, please inform me about them. How it answers, what it costs, etc. A. For naphtha (crude petroleum) firing of boilers, see our SUPPLEMENT, No. 769. Light naphtha is generally to be considered unsafe.

(2460) C. C. asks: 1. What can I use to protect woods from dampness, and prevent warping in models made with it? A. Use only perfectly seasoned woods. Otherwise nothing will preserve the models. Shellac them with good orange shellac dissolved in alcohol. 2. What cement can I use to fasten together strips of cloth or leather on cloth, so as to stand washing in hot and cold water? A. Soak clear glue for ten hours in water enough to cover it, dissolve by heating, and add tannic acid until it is thick and ropy, apply at once with pressure. 3. Explain how electricity may kill when a heavily charged wire breaks and comes in contact with the human body. A. By grounding through the system. This implies, of course, the existence of a second ground or it may be of a series of minute grounds or leakages whose aggregate is enough to cause a strong current to pass through the body. In alternating or pulsating current systems there is also an inductive action like charging and discharging a Leyden jar which will shock without the formation of a second ground. Death by such a shock is very improbable. A second ground of some kind may generally be assumed.

(2461) F. P. C. writes: I noticed in the July 19 issue your request to amateur electrical workers. I will relate some of my electrical experiences. I made the simple electric motor according to the directions given in SUPPLEMENT, No. 641, and met with success. It developed about one man power. I used it for running fly fans, but the large battery required proved rather expensive. Later on I made a motor to run on the Thomson-Houston incandescent current. I used cast iron fields, and wound both fields and armature with No. 28. The armature heated badly on 110 volts, so I rewound the armature with 32; then it did not heat, but developed very little power. I used an armature like the one used in the simple electric motor. I think I would have had better success if I had used the Siemens armature. Later on I made an induction coil similar to the one described in SUPPLEMENT, No. 160. Instead of bare, I used covered wire, and wound each layer the full length on the coil, insulating each layer with one thickness of paraffined paper. After mounting it with condenser and all, I connected two cells of a large plunging bichromate battery. It gave about five-eighths inch sparks. I wound only one pound on the secondary coil. Afterward, hoping to obtain a larger spark, I used more battery. It gave a longer spark at first, then afterward it would give only one-fourth inch spark. I am afraid the extra battery burnt it out. I shall rewind it. A. You will find it advantageous to rewind your coil in two sections, as described in SUPPLEMENT, No. 160.

(2462) D. E. W. asks: 1. In Notes and Queries of a back paper you say the simple electric motor can be changed to a dynamo by shifting the commutator brushes on the other side. Please explain. A. It is necessary to shift the brushes on account of the change in the direction of the rotation of the commutator cylinder. In addition to this change, the field magnet should be made of soft cast iron. 2. Will it hurt the working capacity of the motor if I paint the Russia iron of the field magnet with asphaltum varnish? A. You can paint or varnish the parts referred to without detriment. 3. Would it be dangerous to attempt to stop the motor by taking hold of the pulley? Could it be stopped in this way? A. The principal danger would be of burning your fingers by the friction of the pulley. Of course there would be danger of injury by the current if the machine were placed in a lighting circuit. 4. What would be the lighting capacity, when run as a dynamo? A. Very small; probably 4 or 6 candle power. 5. Will the motor operate a 1 gallon ice cream freezer? A. With sufficient current it would. 6. Would it do to operate the motor by Brush arc light circuit? A. The E. M. F. is unnecessarily high; the machine is not designed for a current of that kind.

(2463) P. P. K. asks: Can I make the tubular shaft and the center (solid) one in the Wimshurst induction machine, also the washer and nut to fasten the revolving plate with, of iron? A. Use well seasoned hard wood for your hubs. 2. Can I set the revolving plate three-eighths or one-half inch apart, as it is nearly impossible to get the plate set firm enough with nut one-sixteenth inch thick? A. You cannot expect good results without setting the plates near together. 3. How large should the brush sockets be, and how many? A. The brush sockets should be one-eighth or three-sixteenths diameter. Four are required. 4. How can I get window panes straight? Nearly every pane is a little curved and unfit for revolving plate. A. You can select flat panes of glass at any large establishment dealing in the article. 5. Will the machine work better if it is made air tight? A. If made air tight and kept dry within, its working will be improved. 6. Cau I make the handle of the electrode of wood? A. Yes. 7. Is 22 turns per inch of 35 wire on the secondary coil of an induction coil enough? A. Yes. 8. Is the platinum contact on the spring necessary? A. Yes. 9. Can I use a soft iron rod instead of the wire bundle? A. No. A bundle of soft iron wire is required.

(2464) W. F. G. asks (1) if there is any method of electro-plating brass and iron with platinum. A. No successful method of electro-plating with platinum is known. 2. The best way to straighten pieces of iron wire about 2 inches long. A. The wire should be straightened in long lengths by means of the machine known as the wire straightener. Short pieces are sometimes straightened by rolling them between heavy flat plates of iron. 3. In boiling carbon plates in paraffine, steam arises and covers the whole plate with a thin film. Will this not interfere with the working of the battery? And if so, how can it best be prevented? A. Carbon plates should not be boiled in paraffine. The end only of the plate should be heated and filled by dipping into melted paraffine, or by rubbing a piece of paraffine over the heated portion of the plate.

(2465) W. J. H. says: Would you please tell me through the next number of your SCIENTIFIC AMERICAN what is the thorough meaning of the astronomical term Milky Way and about what time this term came into use or whom it was first known to? I have been a subscriber to the SCIENTIFIC AMERICAN for nearly two years through a news dealer, and I consider it one of the finest scientific papers there are. A. The "Galaxy" or Milky Way is from γαλα a Greek word signifying milk, and was so named by the early Greek astronomers from its irregular milky whiteness, not then supposed to be stars, but of a cloudy substance. The Latins called it *Via Lactea*.

(2466) A. A. A. asks for a solution that felt may be dipped in, that will make it fireproof against flame and still be pliable and porous. A. Tungstate of soda is about the best fireproofing chemical. The trouble will be in adequately impregnating the felt with the solution.

(2467) J. L. D. writes: I have a drum two feet by three feet. How can I fill it with common illuminating gas, without the use of water in the drum, or without exhausting the air from the drum? A. Blow gas into and through it, the inlet pipe delivering it as near the top as possible. In a short time it will displace the air.

(2468) W. F. S. asks: 1. Can plaster of Paris be made hard by some mixture so it will not break easily and will not lose its color? A. Yes. Mix it with 3 to 10 per cent of powdered marsh mallow root. 2. Will you please tell me how to make some hard white cement? A. Use above mixture. 3. Can this be moulded in plaster of Paris moulds? A. Yes. 4. If so, what will prevent it from sticking to the moulds? A. Oil the interior surface of the mould.

(2469) W. F. B. asks (1) how to soften a rubber stamp that has grown hard. A. It cannot be done. 2. What to use to dilute hektograph ink that will not flow well. A. Use water or alcohol.

(2470) F. A. R. asks for a simple receipt for making furniture polish to clean old furniture. A. The simplest preparation is a mixture of 1 pint turpentine and 4 ounces finely scraped beeswax. A more complicated formula is: Beeswax ½ pound, linseed oil and spirits of turpentine each ½ gill. Either of these may be colored with alkanet root. For the latter, ¼ ounce of the root should be melted up with the wax first. For the first, ½ ounce of the root may be added.

(2471) C. H. H. asks (1) how to destroy the musty smell which we have so frequently in brick houses. A. To destroy this odor, keep the house well ventilated, allow no trees to grow near it, in order that plenty of sunlight may fall upon the walls. 2. The best work on designs for farm barns. A. We recommend and can supply "Barn Plans and Outbuildings," $1.50.

(2472) J. C. B. asks for a recipe for mildew-proofing awning. A. The following is the simplest. Dissolve separately 5 parts each of acetate of lead and of alum in sufficient water. Heat and mix warm. After standing pour off the clear solution, leaving the white residue of sulphate of lead, into 500 parts of water containing a little isinglass. Saturate the awning by soaking for 24 hours in this solution. Many other formulas are given.

(2473) L. J. E. asks for a formula for a finger nail polish. A. Use putty powder, true oxide of tin, perfumed with otto of lavender and colored pink with cochineal if desired.

(2474) G. L. S. asks: 1. How can the color in a meerschaum pipe be made to go to the top of the bowl? A. Use a second bowl placed on top of the regular bowl. This will color the upper edge. 2. Is there any particular method to follow in coloring a meerschaum? A. No; simply use it for smoking, and clean occasionally, as directed in query No. 2364. 3. Please give directions for making a small induction coil making spark enough to light one gas jet. A. Use a spark coil made by winding 3 or 4 pounds of insulated wire around a bundle of small iron wires, six inches long and an inch or so thick.

(2475) P. C. N. asks (1) how to treat horn so it will become soft and pliable. A. Immerse in hot water. 2. How to prevent buckskin from becoming hard by washing. A. The only treatment is to waterproof it. This may be done by working neats foot oil and tallow into it by rubbing.

(2476) N. A. D. asks for an approved method for determining the air-dry weight of wood pulp such as is used in newspaper manufacture. A. Expose a weighed sample to the air, and weigh it until it reaches constant weight.

(2477) F. W. P. & F. E. E. ask: 1. What is a good liquid formula for cleansing and preserving the teeth and sweetening the breath? A. Any number of formulas can be given. The following is said to be very good: Carbonate of potash ½ ounce, honey 4 ounces, alcohol 2 ounces, water 10 ounces, flavor to suit with oil of rose and of wintergreen. 2. What is good to apply to the face after shaving, to keep it from getting sore or festering around the roots of the hair? A. Cyanide of potassium 6 grains, glycerine ½ ounce, strong camphor water 2½ ounces, mix. This is poisonous and should be compounded by an apothecary. Only fresh cyanide of potassium should be used.

(2478) W. D. T. writes: I would like a receipt for cleaning straw hats. A. Brush over with soap and water; after washing off the soapsuds sponge with a weak solution of oxalic acid.

TO INVENTORS.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

September 23, 1890,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Accordion, J. F. Stratton 437,059
Alarm. See Fire alarm.
Aluminum, electro depositing, J. A. Jeancon 436,895
Anchor for buildings, W. D. Baker 436,767
Axle box, J. M. Knaus 437,122
Axle machine, S. Harris 437,029
Axle skein, G. M. Farnsworth 436,527
Baling press, H. Kile 437,120
Basket, wire and slat, M. A. Hamilton 436,917
Bed, folding, H. A. Gore 437,151
Bed, folding, Smith & Bachman 437,058
Bedstead, folding, H. A. Gore 437,150
Bee swarmer, F. D. Lacy 437,123
Bell cord attachment, W. Tyler 437,062
Belt, electric, L. D. Ashbrook 437,079
Belt stretcher, B Meier 436,797
Beverages, preparing carbonated, G. C. Henry 436,782
Bicycle, T. J. Thorp 436,844
Bicycle lock, K. Parke 436,800
Block. See Hat block. Paving block.
Blow tester, coin-controlled. J. M. Akers 436,819
Boiler. See Steam boiler.
Boiler, D. Best 436,933
Bolt. See Finger guard bolt.
Bolt, G. S. Smith 437,054
Book backing machine, C. Weltner 437,066
Book, combined receipt and record, H. Lowenbach 436,983
Book, shipping receipt, J. Howe 436,786
Bottle filling device, Ritter & Stange 437,000
Bottling apparatus, rotating, A. Rempen 436,999
Box. See Axle box.
Box with two compartments, C. P. B. Peck 437,042
Brake. See Locomotive driver brake.
Brick or tile machines, die for, W. W. Wallace 436,929
Brick pressing machine, W. L. Holman 436,894
Brush, commutator, C. Wirt 436,964
Burner. See Gas burner. Hydrocarbon oil burner. Incandescent burner. Oil burner. Refuse burner.
Burnisher, W. H. Boles 436,866
Butter in milk, device for determining the amount of, J. T. Riley 437,133
Button, A. J. Shipley 437,003
Cable grip, E. R. Guerra 437,110
Cable grip, traction, J. Hird 436,955
Calendar and memorandum pad, combined, J. T. Story 437,058
Camera. See Photographic camera.
Can. See Shipping can.
Can body making machine, P. Jordan 436,972
Can body making machine, Jordan & Hodgson 436,791
Can cap, W. D. Brooks 437,086
Can cleaning machine, G. L. Merrell 436,560
Cans, machine for cleaning the tops of, G. L. Merrell 436,836
Cant hook, G. M. Ayers 437,080
Car construction, G. L. Harvey 436,893
Car coupling, J. D. Carr 437,092
Car coupling, W. J. Godsey 436,954
Car coupling, B. R. Hooks 437,117
Car coupling, N. Kramer 436,859
Car coupling, A. C. Martin 436,796
Car coupling, H. Sommerfeld 437,055
Car door, grain, C. H. Emery 437,147
Car seat, E. N. Gilfillan 436,829
Car, sleeping, J. B. Davenport 436,890
Car wheel, J. A. Lacroix 436,897
Car wheel, J. Mulligan 436,876
Card forming machinery, H. E. Cunningham 437,021
Carriage wear iron, R. D. Jacobus 436,907
Carrier. See Trace carrier.
Case. See Clock case.
Chair. See Convertible chair. Rail chair. Railway chair.
Chuck, car wheel, N. S. Bouton 436,586
Churn motor, W. Omer 436,992
Churn power, J. S. Dickey 437,100
Clamp. See Spring clamp.
Clock, alarm, A. M. Lane 436,922
Clock case, A. M. Lane 436,919
Clock key, A. M. Lane 436,921
Clock pendulum, G. P. Reed 436,941
Clock synchronizer, A. G. Wiseman 437,168
Clocks, duplex escapement for, C. B. Hibbard 436,783
Coal or rock drill, Wantling & Johnson 436,815
Coke and gas, apparatus for making, C. N. Trump 436,882
Collar, horse, C. A. Ludewig 436,875
Collar or cuff, waterproof, J. W. Hyatt 436,787
Concentrator, C. E. Seymour 436,807
Convertible chair, Fant & Anderson 436,953
Contact device, electric, J. J. Hoppes 436,874
Cooking vessel, E. A. Peck 436,903
Cores, mould for forming, W. N. Reddout 436,998
Corn husker, J. S. Cuttell 436,776
Cotton gin, roller, F. H. Chase 437,172
Counterguard, G. C. Peck 437,130
Coupling. See Car coupling. Electric wire coupling.
Crimping machine, J. G. Hodgson 436,784
Crutch, G. W. Doe 437,024
Cuff holder, W. T. Wood 437,074
Cultivator, J. P. L'Homedieu 436,795
Cultivator, gang, W. P. Snepp 436,957
Cultivator shovel, C. A. Anderson 436,911
Cut-out, thermal, G. H. Whittingham 436,952
Cycle wheel, A. H. Overman 436,995
Dials, spindle for timepiece, M. V. B. Ethridge 436,973
Door check, W. Shipsey 436,809
Door securer, A. D. Norton 436,840
Drawings, producing line, L. O. Vincent 437,063
Drill. See Coal or rock drill.
Drinking fountain, automatic, J. D. Houston 437,031
Dynamos, speed regulator for, S. E. Nutting 436,901
Ecraseur, castration, Fergen & Macwhinnie 437,148
Elastic woven fabric, Green, Jr., & Sawyer 436,872
Electric conduit, underground, C. E. Loth 437,126
Electric heater, E. Abshagen 436,864
Electric light shade holder, L. J. Atwood 437,008
Electric machine or motor, dynamo, M. Mayer 437,160
Electric wire coupling, J. J. Humphey 437,116
Electric wire coupling, F. R. Jones 436,857
Electrical apparatus, impregnating parts of, F. L. Rawson 437,044
Engine. See Explosive engine. Gas engine. Hoisting engine. Rotary engine. Rotary steam engine. Steam engine. Traction engine.
Engine, A. J. Bates 436,768
Engraving machines, turning point attachment for, A. E. Francis 437,137
Eraser, G. F. Deuneriohr 436,891
Eraser, blackboard, H. E. Gardiner 437,106
Eraser, slate, S. S. Sloan 436,863
Explosive engine, J. W. Eisenhuth 436,936
Explosives, manufacture of, H. S. Maxim 436,898
Eyeglass holder, J. H. Knowles 436,831
Eyeglasses, J. King 437,121
Eyeglasses, Emonds & Bishop 436,971
Fabric. See Elastic woven fabric. Wire fabric.
Fare register, J. H. Rose 436,805
Feed water, heating, C. H. Uhler 436,845
Fence, M. T. Swope 436,904
Fence post, C. A. Peterson 437,165
Fence post, E. Sims, Jr 437,050
Fence posts, wire fastener for, W. Heifenberger 437,155
Fence stay, wire, M. S. Tarkington 436,950
Fence, wire, E. Sims 437,005
Fiber cleaning and polishing machine, vegetable, W. F. Falconer 436,870
File, paper, J. M. Willis 437,071
Finger guard bolt, D. Woehrle 437,072
Fire alarm, J. H. Earles 436,869
Fire alarm, portable electric, Upton & Dibble 436,961
Fire escape, J. D. Carr 437,091
Fire escape, T. W. Mann 436,834
Freight, apparatus for handling coal, ore, or other, R. Thew 436,928
Fuel, artificial, W. B. McClure 437,164
Fuel, manufacturing artificial, W. B. McClure 437,163
Furnace charging and discharging apparatus, M. P. Higgins 436,856
Furnace linings, apparatus for repairing, G. W. Goetz 436,976
Gauge. See Ring gauge. Spectacle gauge.
Game apparatus, W. C. Kantner 436,980
Game counter, S. B. Jenkins 436,896
Game counter, S. Stieglitz 437,057
Garment supporter, W. H. Plumb 437,043
Gas, apparatus for making hydrogen, J. W. Tallmadge 436,812
Gas, apparatus for the manufacture of oil, D. E. Teal 436,881
Gas burner, coal oil, G. Beck 436,885
Gas generator, C. W. Gibson 436,975
Gas generators, stand pipe for ammonia, Poschinger & Vogt 436,994
Gas lighter and extinguisher, automatic, N. Newman 436,990
Gas machine, J. S. Wood 437,136

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Gas meter, J. W. Culmer 437,020
Gas producer, J. W. Culmer 437,098
Gate. See Railway gate.
Gate, E. H. Boyce 437,085
Generator. See Gas generator.
Glass, annealing oven for plate, R. G. Guptill 437,027
Glass rolling mechanism, plate, R. G. Guptill 437,028
Glassware, machine for pressing and blowing, E. & J. A. Jones 436,790
Glazed structures, sheet metal bar for, W. F. Mills 437,129
Glove fastener, A. G. Mead 437,161
Glove fastener, A. J. Shipley 437,004
Governor, J. F. Kirby 436,938
Grain binder cord holder, H. E. Pridmore 436,909
Grate, J. Tontz 436,813
Grinding mill, W. Buchholz 437,087
Grinding mill, H. H. Coles 437,144
Grip or clamp, J. W. Crawford 436,967
Grooved switch, W. H. S. Wright 436,944
Guard. See Counter guard.
Gums, envelopes, etc., moistening device for, R. E. Booraem 436,822
Gun, automatic, H. S. Maxim 436,899
Gun, breech-loading, J. M. & M. S. Browning 436,965
Gunstock, skeleton, H. M. Quackenbush 436,997
Gypsum, calcining, J. Sickler 437,140
Hame hook, J. H. Watson 437,064
Handle. See Lock handle. Velocipede handle.
Hanger. See Pipe hanger.
Harness, Lovett & Purcell 437,159
Harrow, disk, C. La Dow 437,124
Harvester, C. Miller 436,798
Harvester, corn, J. Armstrong 436,885
Harvester, corn, W. W. Burson 436,823
Harvester, cotton, G. Beekman 436,770
Harvesting machine, J. C. Harding 437,118
Hasp lock, combination, W. J. Mundt 437,034
Hat block, G. F. Larkin 436,833
Hat bodies, apparatus for dipping, H. M. Chittenden 436,771
Hat or bonnet fastener, L. Rosenfeld 437,045, 437,046
Hat tag, J. H. Ricketts 437,132
Hay press, O. F. Dubois 437,146
Heat indicator and alarm, electric distance, F. W. Wiesebrock 437,069
Heater. See Electric heater.
Hoisting device, W. P. Campbell 437,088
Hoisting engine, O. Flohr 436,828
Holder. See Cuff holder. Electric light shade holder. Eyeglass holder. Grain binder cord holder. Paper holder. Rein holder. Sponge holder.
Hook. See Cant hook. Hame hook. Lacing hook.
Horseshoe, A. N. Green 437,152
Horseshoe, G. W. Rice 436,803
Hydrocarbon oil, apparatus for burning, J. S. Hull 436,918
Hydrocarbon oil burner, J. T. Black 437,013
Incandescent burner, C. B. Harris 437,114
Indicator. See Heat indicator. Station indicator. Water closet indicator.
Inhaler, F. W. Wiesebrock 437,070
Injector, D. Best 436,932
Inkstands, adjustable pen rest for, H. C. Thomson (r) 11,112
Insecticide, Farwell & Rhines 436,848
Iron. See Carriage wear iron.
Iron in cupola furnaces, remelting, H. J. Graf 437,109
Jack. See Lifting jack. Pegging jack.
Joint. See Pipe joint.
Key. See Clock key.
Kneading or mixing device, dough, F. C. Davis 437,099
Knife. See Pocket knife.
Knife, W. P. Bailey 437,081
Knitting machine thread guide, J. Power 436,996
Knitting machines, yielding cam stop for straight, H. M. Lecture 436,982
Lacing hook, H. T. Sperry 436,958
Lamp chimneys, etc., tool for finishing, C. Hamm 437,154
Lamp, electric arc, A. Wagniere 436,814
Lamp, safety, J. Thorne 437,061
Lamp, safety apparatus, oil, J. Stark 436,879
Lasting machine, E. S. Combs 436,772
Lasting machine, Combs & Goodhue 436,773
Lasting machine, I. N. Forbes ..... 436,849 to 436,853
Latch and lock combined, D. E. Grant 436,780
Lathes, speed changing mechanism for, L. E. Whiton 437,067, 437,068
Laundry table, M. McClure 436,839
Lawn sprinkler, D. A. Hoyt 437,118
Lawn sprinkler, T. Scheen 436,942
Lawns, metallic edging for, W. Bicknell 436,821
Lifter. See Transom lifter.
Lifting jack, J. W. Alfred 437,077
Lifting jack, H. Wilson 436,943
Lock. See Bicycle lock. Hasp lock.
Lock handle, N. G. Sorensen 437,007
Locomotive driver brake, G. A. Boyden 437,171
Loom, G. A. & J. F. Greene 436,937
Lubricator, C. C. Rueger 436,927
Lumber assorter, J. B. Mahaffey 436,984
Match, W. M. Nix 436,877
Match splints, machine for making, G. E. Norris 436,991
Measure, rotary, W. C. Wells 437,065
Measuring device, grain, M. Cashin 437,093
Meter. See Gas meter.
Mill. See Grinding mill. Ore mill.
Mop and wringer, combined, C. A. Chisholm 437,143
Motor. See Churn motor. Thermo motor.
Motor, J. F. Weddendorf 436,930
Mower, P. & L. P. Lorenz 436,947
Mower, J. A. & A. A. Peterkin 436,878
Mowing machine, B. Branson 436,912
Mowing machine, R. H. Dixon 436,825
Nailing machine, A. H. Wolcott 437,073
Nautical magnetic tracer apparatus, F. Aramburu 437,169
Oil burner, G. P. Way 436,816
Oil transporting tank and wagon, H. McFarland 436,840
Optical instrument, coin-controlled, E. J. Colby 436,905
Ore concentrator, C. E. Seymour 436,808
Ore mill, H. J. Clark 437,017
Organ, reed, J. Peloubet 437,131
Osteotome, electro, M. J. Roberts 436,804
Oyster beds, machine for removing star fish from, S. M. Corwin 436,935
Paint or varnish, apparatus for polishing, F. Harrington 436,892
Pallets, fastening for escapement, A. M. Lane 436,920
Pans, making muffin or bake, C. L. Waxandt 436,883
Paper hanging machine, P. McQueney 436,924
Paper holder and cutter, roll, S. C. Jobes 436,789
Paving block, D. E. McDowell 436,989
Pegging jack, J. F. Fiske 436,974
Pen for swine, breeding, B. F. Osborn 436,902
Perforating machine, L. H. Stellmann 436,810
Photomechanical printing plates, producing, R. Aramburo 437,170
Photographic apparatus, coin-operated, C. H. C. Foge *et al* 437,104
Photographic camera shutter, F. A. Hetherington 436,855
Pigtrough, S. E. Smith 436,956
Pipe covering, steam, Palmer & Baier 437,041
Pipe hanger, E. V. Clemens 437,018
Pipe joint, E. V. Clemens 437,019
Pipe jointing apparatus, J. F. Fischer 436,915
Pipe laying apparatus, J. F. Fischer 436,914
Planter and fertilizer distributer, corn and cotton seed, T. M. Yarbrough 437,075
Planter, seed, J. H. Gardner 436,871
Plow evener, J. A. Kenney 437,032
Plow, wheel, W. H. Melder 436,985
Pocket knife, B. Von Bultzingslowen *et al* 436,888
Polishing and buffing device, W. Church 436,868
Popcorn balls, mould for making, Wiatt & Pickering 436,818
Post. See Fence post.
Power. See Churn power.
Power mechanisms, electric controller for, R. D. O. Smith 436,843
Power press, L. B. Newell 437,038
Power transmitting apparatus, T. A. Edison 436,970
Press. See Baling press. Hay press. Power press.
Pressure governor, fluid, G. Kimball 436,858
Price card fastener and exhibitor, D. K. Appenzellar 437,078
Printer's composing stick, C. Kimplen 436,981
Printing press attachment, W. E. Freer 437,105
Printing presses, ink fount for, Cormack & Whitlock 436,847
Printing presses, doctor-roller mechanism for, S. Whitlock 436,846
Propeller, O. T. Welch 436,817
Propeller wheel, E. D. Bangs 436,769
Propeller wheel, G. W. Pelton 436,802
Pulley, split, H. C. Lewis 437,125
Pump, measuring, L. D. & P. W. Miller 437,162
Puzzle, block, J. A. Ruezer 437,002
Rack. See Show rack.
Rail chair, A. J. Moxham 436,988
Rail chair, girder, A. J. Moxham 436,987
Rail joint fastener, E. G. Patterson 436,995
Railway chair, D. N. Cook 436,774
Railway, electric, R. M. Hunter 437,158
Railway, electric, H. W. Libbey 436,923
Railway frog, A. M. Grubbs 436,906
Railway gate, J. B. Carey 437,089
Railway, pneumatic, J. B. Kelley 436 946
Railway signal, mechanical and electrical, B. R. Davidson 436,777
Railway tie plate, C. D. Halsey 437,153
Railway time signal, B. R. Davidson 436,913
Railway rails, brace chair for, M. M. Suppes 436,959
Railway, fog signaling apparatus for, I. F. Taylor 436,88.
Refrigerator car, M. A. Garrett 437,107
Refuse burner, water heater, and steam generator, H. Auchu 437,009
Register. See Fare register.
Rein holder, L. Larson 436,798
Resistance, artificial, E. M. Bentley 437,011
Rheostat, J. H. Gunning 437,111
Ring gauge, A. W. Engel 436,972
Rock drills, cylinder head for, G. J. Slining 437,051
Roll pass, M. M. Suppes 436,960
Roofing material, fabric, R. S. Merrill 437,033
Rotary engine, B. B. Bower 436,867
Rotary steam engine, G. Abrams 437,076
Rubber shoes, heel protector for, J. Siegel 437,049
Ruler and ink pad, combined, W. J. Boynton 436,887
Ruler, parallel, B. E. Sawyer 436,842
Sad iron, F. B. Thaler 436,951
Sand screen, P. Drendul 437,025
Sash fastener, F. E. Drake 437,103
Sash fastener, Z. Pinard 436,841
Sash fastener, A. B. Richardson 436,926
Saw, circular, W. A. Miller 437,128
Sawing machine, J. H. Raymond 437,138
Scaffold, A. T. Sears 436,806
Scales, automatic grain weighing, Gunder & Pierce 436,854
Scales, coin-controlled weighing, W. R. Smith 437,166
Scales, pendulum, J. B. Martin 436,835
Scarf fastener, G. E. Surgi 437,060
Screen. See Sand screen.
Screw, roof, D. B. Corley 436,775
Seat. See Car seat.
Seed hulls, treating cotton, E. Bohn 437,084
Sewing looped fabrics, machine for, N. H. Bruce 437,142
Sewing machine cover, E. H. Craige 437,145
Sewing machine looping device, W. E. Bennett 437,083
Sewing machine shuttle, L. A. Miller 436,837
Sewing machine shuttle and shuttle carrier, P. Diehl 437,023
Shaft attachment, vehicle, D. S. Field 436,945
Sheet metal notcher, J. H. Eller 436,826
Shipping can, C. D. Chase 437,094
Shovel. See Cultivator shovel.
Show rack, T. F. McGann 437,035, 437,036
Signal. See Railway signal. Railway time signal.
Soldering vent holes in can tops, machine for, J. G. Hodgson 436,785
Spectacle gauge, M. J. Hinden 437,040
Spinning or twisting machine, E. Dawes 437,022
Sponge holder, N. Morris 436,838
Spring clamp and fastener, C. McPike 437,037
Sprinkler. See Lawn sprinkler.
Stage scenery, J. F. Byrnes 437,016
Stage scenery, mechanical horse for, J. F. Byrnes 437,015
Stall floor, A. Goodyear 436,778
Station indicator, F. Rochow 437,001
Steam boiler, C. Otis 437,040
Steam engine, P. T. Coffield 437,097
Stereotypes, adjustable drying frame for matrices or moulds for, C. Ostermann 436,925
Stirrup, F. A. Goodridge 437,108
Stove, base burning, A. H. Pegg 436,801
Stovehood, E. J. Smith 436,052
Stove oven, J. Jewett 436,788
Supporter. See Garment supporter. Uterine supporter.
Switch. See Grooved switch.
Switch, C. H. Hobson 437,156
Swing, T. W. Bowen 437,014
Syringe, hypodermic, Fergen & Macwhinnie 437,149
Table. See Laundry table.
Tank. See Oil transporting tank.
Tapping machine, H. W. Honeyman 437,157
Telephone exchange system, E. M. Bentley, 437,010, 437,012
Thermo motor, internal combustion, J. Hargreaves 436,781
Tinning or retinning pans, machinery for, J. Monto (r) 11,111
Toy, Bandy & Cole 437,082
Trace carrier, A. E. Clark 437,096
Traction engine, D. Best 436,931
Transom lifter, E. Herz 437,115
Trimmer. See Wick trimmer.
Trough. See Pig trough.
Truck, car, J. Taylor 437,167
Truck, electric motor car, E. W. Goss 436,779
Trucks, corner iron for, W. B. Morris 436,986
Tube. See Wick tube.
Twine making machine, G. A. Lowry 436,908
Typewriting machine, W. J. Barron 436,820
Typewriting machine, W. M. Carpenter 437,090
Typewriting machine, J. B. Gathright 436,916
Typewriting machine, H. R. Kennedy 437,119
Typograph, F. E. Bright 437,141
Typograph, J. R. Rogers 437,139
Umbrella sticks, inscription device for, J. McLaughlin 436,799
Underwaist, G. M. Sigsbee 436,862
Uterine supporter, A. T. Sherwood 436,861
Valve, steam actuated, D. E. Kempster 436,830
Valve, stop, G. Adam 436,884
Vehicle, C. J. Sullivan 436,949
Vehicle curtain fastener, J. Watters 436,962
Vehicle top, R. D. Morrison 436,900
Velocipede, R. Flachs 437,026
Velocipede, E. E. Hardy 436,873
Velocipede handle, M. Hoyt 436,978
Velocipede, railway, I. E. Stump 436,811
Velocipedes, electric signal for, C. G. Jiran 436,979
Vending apparatus, J. Schofield 437,048
Veneer and board cutting machine, G. A. Oncken 437,039
Vine securing device, J. Stangl 437,056
Violins, base bar for, M. W. White 436,963
Vise, punch, and drill, combined, J. N. Sargent 437,047
Wall decoration, J. C. Haire 437,112
Walls, ornamentation of, M. B. Church 437,095
Washing machine, C. W. Leubner 436,794
Water closet indicator, J. Dihrberg 437,101
Weighing machine, electrical, W. Snelgrove 436,910
Well sinking machines, point for, J. R. & W. B. Coffin 436,889
Wheel. See Car wheel. Cycle wheel. Propeller wheel
Whiffletree, G. J. Smith 437,006
Whip, J. W. Middleton 437,127
Wick trimmer, W. R. Cole 436,934
Wick tube and attachment, J. McConnell 436,948
Winding drum, J. M. Chatfield 436,824
Window bead fastener, M. Lane 436,949
Wire drawing drum, W. W. Shearer 437,135
Wire fabric, J. Hancock 436,977
Wire, method of and apparatus for drawing, T. A. Edison 436,968, 436,969
Wire stretchers, gripper for, C. La Grange 436,832
Wood char'eling mach., guide for, A. B. Cameron 436,906
Wrench, C. W. Dixon 437,102
Yarn dressers, section tension indicator for, T. J. Sands 437,134

DESIGNS.

Badge, N. S. Boynton 20,159
Book or album leaf, E. G. Thorp 20,166
Box, M. J. Bogert 20,167
Button hook, W. J. Keys 20,160
Cane or umbrella handle, A. Rosenstein ..... 20,162 to 20,164
Cane or umbrella handle plate, F. H. La Pierre 20,170
Music rack, W. P. Haynes 20,168
Paddle, G. Ralbert, Jr. 20,161
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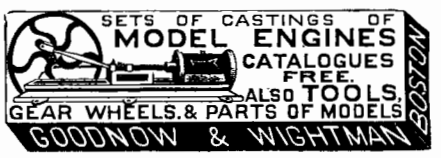

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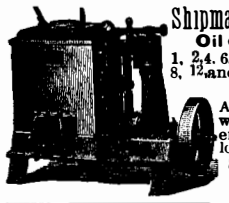

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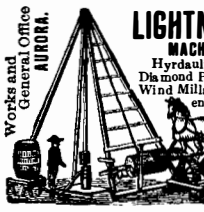

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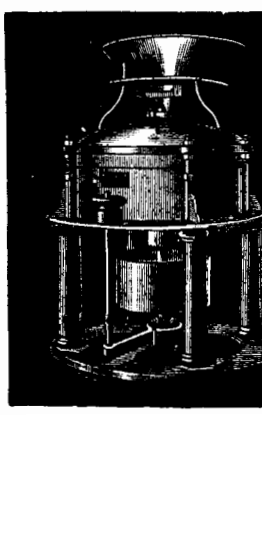

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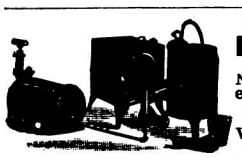

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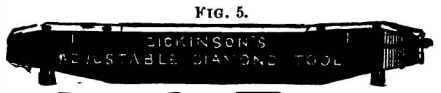

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FIG. 3.

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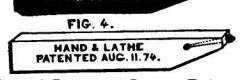

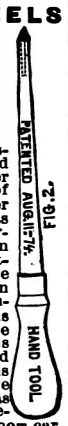

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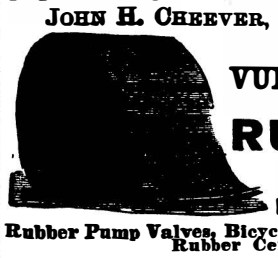

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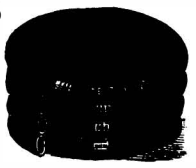

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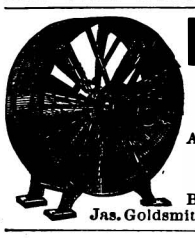

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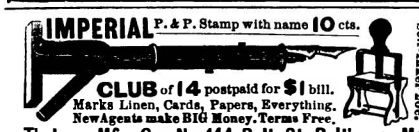

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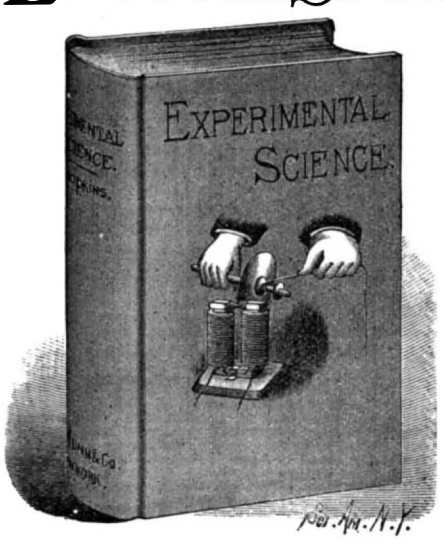

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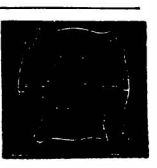

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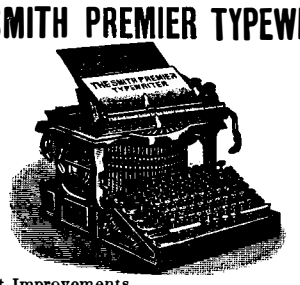

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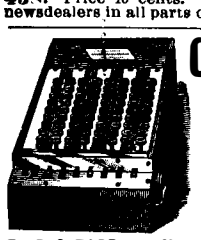

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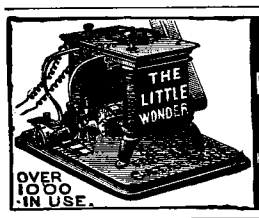

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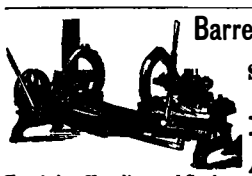

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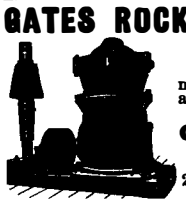

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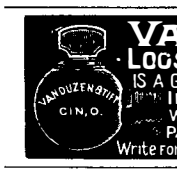

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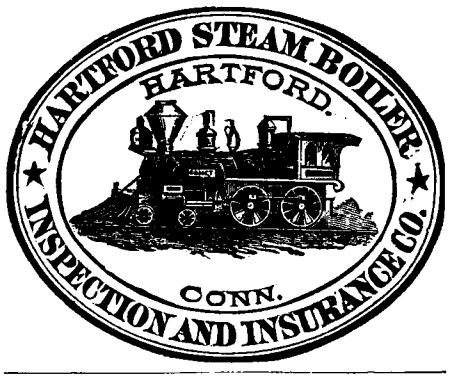

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